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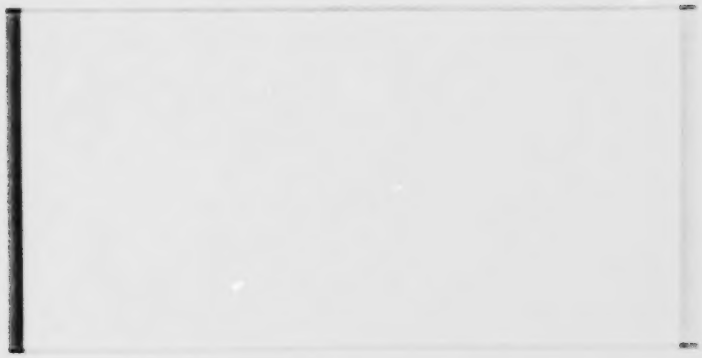

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ASH CELL GROUNDWATER QUALITY 1985
THUNDER BAY TGS EXTENSION

Report No 86-22-K

J. Complak
Chemist
Process Chemistry Section
Chemical Research Department

ABSTRACT

Data on the physical and chemical characteristics of groundwaters from the coal ash storage area at Thunder Bay TGS, for 1985, are summarized in this report. The 1985 data show an improvement in general water quality at all sampling locations. Groundwater in one location did, however, show a substantial increase in boron concentration. This increase in boron content will be watched during the next monitoring period.

job	file	date	report no.
740631-143-592	837.71	July 25, 1986	86-22-K

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EXECUTIVE SUMMARY

ASH CELL GROUNDWATER QUALITY-1985 THUNDER BAY TGS EXTENSION

J. Complak
Chemist
Process Chemistry Section
Chemical Research Department

Data on the physical and chemical characteristics of groundwaters from the coal ash storage area at Thunder Bay TGS, for 1985, are summarized in this report. This survey was a continuation of the 'preoperational' groundwater surveys conducted by London Monenco Consultants during 1976-1978 and by Ontario Hydro, during 1979-1980 and of the postoperational surveys conducted by Ontario Hydro since 1980.

These surveys were conducted at the request of Ontario Hydro's Central Thermal Services - Environmental Protection Department on behalf of the Thunder Bay Project.

The 1985 data on the groundwater characteristics show an improvement in general water quality at all sampling locations.

job	file	date	report no.
740631-143-592	827.71	July 25, 1986	86-22-K

TABLE OF CONTENTS

	Page
ASH CELL HISTORY - TO END OF 1985	1
METHODOLOGY	4
1. Piezometer Installation	4
2. Piezometer and Groundwater Level Surveys	4
3. Groundwater Sampling	4
4. Groundwater Tests and Analyses	5
5. Rationale	6
RESULTS OF FIELD AND LABORATORY WORK CONDUCTED IN 1985	7
1. Piezometer Network Level Survey	7
2. Groundwater Level Surveys	7
3. Groundwater Characteristics	7
DISCUSSION OF 1985 FIELD AND LABORATORY RESULTS	7
1. Piezometer Reference Levels	7
2. Groundwater Levels	11
3. Groundwater Quality	11
4. Conclusions	
REFERENCES	34
APPENDIX A GROUNDWATER CHEMICAL ANALYSIS TBTGS ASH CELL - 1985	
DISTRIBUTION	

LIST OF TABLES

Table		Page
I	ASH DISPOSAL INVENTORY - 1979-85, CELL NO 1 TBTGS	3
II	PIEZOMETER REFERENCE LEVELS - 1978-85	8
III	RELATIVE PIEZOMETER AND LAKE WATER LEVELS - 1985	9
IV	LAKE SUPERIOR WATER LEVELS - 1985 THUNDER BAY HARBOUR FISHERIES AND OCEANS, OTTAWA	10
V	ASH CELL AREA GROUNDWATER QUALITY TBTGS - 1985 TEST: pH	13
VI	ASH CELL AREA GROUNDWATER QUALITY TBTGS - 1985 TEST: ALK HCO_3	16
VII	ASH CELL AREA GROUNDWATER QUALITY TBTGS - 1985 TEST: SO_4	19
VIII	ASH CELL AREA GROUNDWATER QUALITY TBTGS - 1985 TEST: Na	21
IX	ASH CELL AREA GROUNDWATER QUALITY TBTGS - 1985 TEST: Mg	24
X	ASH CELL AREA GROUNDWATER QUALITY TBTGS - 1985 TEST: B	26
XI	ASH CELL AREA GROUNDWATER QUALITY TBTGS - 1985 TEST: Sr	28

LIST OF FIGURES

Figure		Page
1	Ash Disposal Cell No 1, Piezometer Network & Limit of Ash Disposal Thunder Bay TGS	2
2	Ash Cell Storage Area Ground and Lake Water Levels and Total Precipitation - 1985	12
3	TBTGS Ash - Selected Boreholes pH (Lab) vs Time	14
4	TBTGS Ash - Selected Boreholes HCO_3 Alkalinity (Lab) vs Time	17
5	TBTGS Ash - Selected Boreholes Sulphate vs Time	20
6	TBTGS Ash - Selected Boreholes Sodium vs Time	22
7	TBTGS Ash - Selected Boreholes Magnesium vs Time	25
8	TBTGS Ash - Selected Boreholes Boron vs Time	27
9	TBTGS Ash - Selected Boreholes Strontium vs Time	29
10	Major Ion Chemistry-TBTGS-Ash Piper Plot-June 8, 1985	31
11	Major Ion Chemistry-TBTGS-Ash Piper Plot-September 13, 1985	32

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To Mr. D.K.A. Gillies
Manager
Environmental Protection
Central Thermal Services

ASH CELL GROUNDWATER QUALITY - 1985
THUNDER BAY TGS EXTENSION

J. Complak

A survey of groundwater quality in the vicinity of the coal ash disposal site (Cell No 1) at Thunder Bay TGS (TBTGS), was conducted during 1985. This survey was a continuation of the 'preoperational' groundwater surveys conducted by London Monenco Consultants (LMC) during 1976-78/1,2/ and by Ontario Hydro during 1979-81/3,4,5,6/, and of the 'postoperational' surveys conducted by Ontario Hydro during 1982-1984/7,8,9/. The data obtained during the 1985 survey are presented in this report.

These surveys were conducted at the request of Ontario Hydro's Central Thermal Services - Environmental Protection Department on behalf of the Thunder Bay Project. Monitoring of groundwater quality is required as part of the conditions on the Certificate of Approval issued by the Ontario Ministry of the Environment for the coal ash disposal site for Thunder Bay TGS.

ASH CELL HISTORY - TO END OF 1985

The following is a brief outline of the main events in the history of the Ash Disposal Cell No 1, which consists of nine sub-cells, shown in Figure 1.

Preoperational Phase

1. Construction of Cell No 1 was completed by August, 1978.

2. Placement of slurry of wet (leached) bottom ash and fly ash from Unit No 1, burning US bituminous coal, into sub-cell No 1, began in June, 1979.

3. Placement of dry fly ash from Unit No 1 began in September 1980.

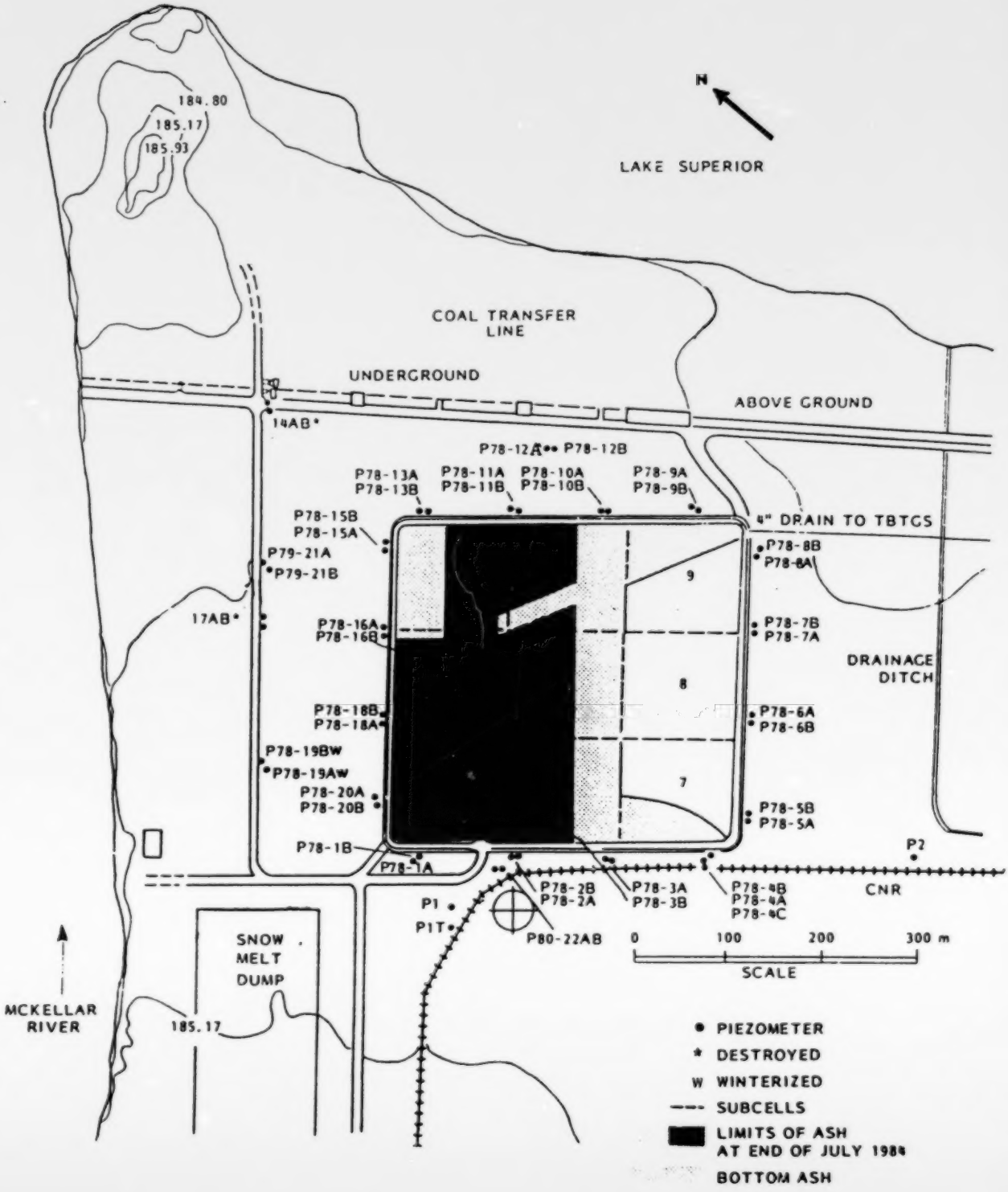

FIGURE 1

ASH DISPOSAL CELL NO. 1
PIEZOMETER NETWORK & LIMIT OF ASH DISPOSAL
THUNDER BAY TGS

Postoperational Phase

4. Placement of dry fly ash and bottom ash from Units No 2 and 3, burning Western Canadian lignite coal, began in May 1981, during burn trials.

5. Unit No 2 was in commercial service since September 1981. Unit No 3 came into commercial service on July 14, 1982.

6. During 1984 about 12 000 Mg of fly ash were sold through the lignite ash marketing program and therefore not placed in the ash cell.

7. From May 1985 all the ash produced was sold and removed from the site.

Table I shows the volumes of ash placed prior to and during 1985.

TABLE I

ASH DISPOSAL INVENTORY - 1979-85
CELL NO 1 - TBTGS

Date	Bituminous Fly Ash m^3	Lignite Fly Ash m^3	Lignite Bottom Ash m^3	Total Ash Placed m^3
To end of 1979	3,430	--	--	3,430
To end of 1980	21,010	--	--	21,010
To end of 1981	18,755	22,571	3,737	45,063
To end of 1982	16,640	57,485	25,974	100,099
To end of 1983	395	99,871	27,067	127,333
To end of 1984	0	75,661	28,042	103,703
January 1985		5,484	2,945	8,429
February 1985		2,451	460	2,911
March 1985		2,059	124	2,183
April 1985		3,094	692	3,786
1985 Totals	0	13,088	4,221	17,309
Cummulative Totals		268,676	89,041	417,947

METHODOLOGY

The following is a general outline of the original preparatory field work carried out and the test methods used to obtain the raw data needed to characterize the hydrology and the quality of the groundwaters in the ash disposal area.

1. Piezometer Installation/1/

In May of 1978, 41 piezometers, arranged in 20 nests, and housed in protective surface casings, were installed around Ash Disposal Cell No 1 (Figure 1). In 1979 piezometers 21A and 21B were installed and in 1980 piezometers 22A and 22B. Further installation details are given in Ontario Hydro Research Report No 85-171.

2. Piezometer and Groundwater Level Surveys

Measurements of the piezometer reference elevations and of groundwater levels in piezometers were conducted by personnel from the Civil Research Department and TBTGS. The levels are reported as elevations relative to the average lake shoreline level of 182.88 m (600 ft) for the Thunder Bay area.

3. Groundwater Sampling

In general, the following water level measurement and sampling procedures were used by station personnel.

(a) Bailing

- Groundwater levels in each piezometer were measured and recorded. The water from each piezometer was bailed out with a hand-operated pump or vacuum pump.

- Four days later the water from each piezometer was bailed out again.

(b) Sampling

- One day after the second bailing in (a) about 1 L of groundwater from each piezometer was collected into an acid cleaned LPE (linear polyethylene) bottle.

  The waters' pH and conductivity were measured immediately with portable pH and conductivity meters.

(c) Preparation

- All samples collected were stored in a refrigerator at about 4°C.

- The samples were filtered as soon as possible using 0.45 µm prewashed Millipore filters.

- A pretreated 500 mL LPE bottle was filled with the filtrate to which were added 2.5 mL of "ULTREX" HNO_3.

- A portion of the remaining filtrate was used for selected field tests.

(d) Shipping

The remaining filtrate (from c) was kept at about 4°C in a cooler with ice packs, and shipped (by air) with the acidified samples to Research Division for analysis.

4. Groundwater Tests and Analyses

(a) Routine Analyses - At TBTGS and Research

All groundwater samples were tested at TBTGS for pH, conductivity and alkalinity.

(b) Comprehensive Analyses - At Research Division

Comprehensive analyses of the groundwater samples were carried out by the Analytic Services Section of the Chemical Research Department, Research Division. The characteristics determined in 1985 are shown below:

Analyte	
pH	
Conductivity mS/m	
Alkalinity (OH, CO_3 and HCO_3) as $CaCO_3$	
Sulphate	SO_4
Chloride	Cl
Calcium	Ca
Magnesium	Mg
Sodium	Na
Potassium	K
Strontium	Sr
Boron	B

(c) Analytical Methods

The analytical methods used were primarily those outlined in the Standard Methods for the Examination of Water and Wastewater, published by the American Public Health Association (14th Edition)/10/.

5. Rationale

(a) Sampling Periods

For 1985, spring and summer months were chosen for groundwater sampling to provide data on groundwater quality during the wet and dry periods. The wet conditions in the spring were expected to produce leachate containing high concentrations of dissolved matter from the ash. These periods represent the extremes of the hydrogeological cycle and provide the most liberal indications of leachate effects on the site.

(b) Field Tests

Because some parameters of natural waters change rapidly after sampling, pH and conductivity were determined in the field on fresh samples, and alkalinity, somewhat later (but as soon as possible), in the station's laboratory.

(c) Parameter Significance

Of the analytes determined, concentrations of Na, Mg, Sr and B are considered to be the main indicators of ash leachate contaminant migration. Alkalinity and SO_4 concentrations are commonly considered to be characteristic of ash leachates but are not considered to be particularly suitable contaminant indicators for this site although they do aid in general characterization of water quality. Alkalinity is subject to change in passage through soil and sulphate concentrations are limited by saturation effects. In addition, SO_4 concentrations in the groundwater in the study area have been found to be highly variable. It is also likely that SO_4 concentrations are affected by natural biological activity in the peat layer.

Sodium is a major component of ash leachate. Its solubility is not limited by saturation effects and it is not expected to undergo significant attenuation in passage through the sandy silt or peat layers.

Occasional checks of Sr and B concentrations in piezometer groundwater samples are also considered useful. Although generally not appearing in concentrations as high as Na, they are present in leachates at levels greater than ten times those in the local groundwater.

Magnesium concentrations could also serve as a suitable leachate contaminant indicator, however, care must be taken in data interpretation when pH levels of the groundwater are high. High pH levels tend to promote precipitation of Mg thus lowering its

dissolved concentration in the water sample. This could contribute to misinterpretation of the data.

RESULTS OF FIELD AND LABORATORY WORK CONDUCTED IN 1985

1. Piezometer Network Level Survey

In 1985, piezometer reference elevation survey was carried out by the Civil Research Department on June 12. The 1985 levels, together with those obtained from 1978 through 1984, are summarized in Table II.

2. Groundwater Level Surveys

Measurements of groundwater levels in piezometers on the perimeter of the ash cell were carried out on three occasions during 1985. The results are shown in Table III. Included in the table are Lake Superior water levels (relative water monthly means) calculated from the daily means data shown in Table IV obtained from Fisheries and Oceans, Services Branch, Ottawa.

3. Groundwater Characteristics

The analytical results obtained at Thunder Bay TGS and at Research on groundwater samples taken on June 8, and September 13, 1985, are shown in Appendix A. The limited results obtained at Thunder Bay TGS are also included in the summary. Because the TBTGS data were obtained on the same samples that were submitted for the comprehensive analyses, the TBTGS results are shown under a different date (one day after the actual sampling) to avoid computer problems in recalling the two separate sets of data in the future.

DISCUSSION OF 1985 FIELD AND LABORATORY RESULTS

1. Piezometer Reference Levels

The piezometer reference levels for 1985, given in Table II, show that from May 15, 1984 to June 12, 1985, only relatively small changes (<0.1 m) occurred in most piezometer levels. Most of the changes were small increases in elevations. The biggest increase was 9 cm in piezometer 07A and 07B. The level of piezometer 02B decreased by 5 cm. The remaining changes were of smaller magnitude. These piezometer level changes indicate that little movement occurred in the ground levels at the site over the year.

Table II

ASH CELL GROUNDWATER QUALITY STUDIES - 1978-1985
THUNDER BAY TCS EXTENSION

PIEZOMETER REFERENCE LEVELS
1978-1985

Piezometer Identification		Piezometer Reference Levels, a (Above Reference Level of 182.88 m)														
		Date Surveyed														
		May 24/78	July 26/78	May 8/79	Nov 2/79	June 5/80	Nov 10/80	July 17/81	Nov 2/81	June 9/82	Nov 3/82	May 10/83	May 15/84	Jun 12/85	Δ	Δ'
P78	1A	2.00	2.01	2.13	2.12	2.17	2.19	2.07	2.15	2.17	2.14	2.19	2.18	2.20	0.02	0.20
	1B	2.12	2.12	2.24	2.24	2.28	2.30	2.19	2.26	2.29	2.26	2.28	2.28	2.32	0.04	0.20
P78*	2A	2.08	2.08	2.21	2.20	2.24	2.26	2.15	2.21	2.24	2.20	2.22	2.18	2.23	0.05	0.15
	2B	2.08	2.09	2.21	2.20	2.25	2.27	2.19	2.22	2.25	2.22	2.23	2.28	2.23	-0.05	0.15
P78	3A	2.07	2.08	2.20	2.21	2.25	2.29	2.24	2.25	2.28	2.25	2.27	2.25	2.28	0.03	0.21
	3B	2.05	1.95	2.08	2.09	2.11	2.15	2.12	2.12	2.14	2.11	2.13	2.11	2.14	0.03	0.09
P78*	4A	2.02	2.04	2.15	2.15	2.19	2.22	2.10	2.17	2.20	2.16	2.18	2.17	2.18	0.01	0.16
	4B	1.99	2.00	2.12	2.11	2.16	2.18	2.06	2.14	2.16	2.13	2.14	2.13	2.15	0.02	0.16
	4C	1.86	1.87	1.99	1.98	2.03	2.05	1.95	2.02	2.04	2.01	2.02	2.04	2.09	0.05	0.23
P78	5A	1.92	1.93	2.06	2.12	2.19	2.22	2.13	2.23	2.25	2.22	2.29	2.34	2.40	0.06	0.48
	5B	1.87	1.88	1.99	1.98	2.04	2.08	2.00	2.08	2.12	2.08	2.13	2.15	2.19	0.04	0.32
P78*	6A	1.79	1.81	1.92	1.91	1.96	1.98	1.95	1.84	1.97	1.93	1.94	1.94	1.96	0.02	0.17
	6B	1.80	1.81	1.93	1.91	1.96	1.98	1.93	1.99	1.96	1.92	1.94	1.94	1.96	0.02	0.16
P78	7A	1.69	1.71	1.82	1.81	1.87	1.90	1.81	1.89	1.92	1.88	1.86	1.85	1.94	0.09	0.25
	7B	1.76	1.78	1.90	1.89	1.94	1.98	1.90	1.98	2.01	1.98	2.00	2.01	2.10	0.09	0.34
P78	8A	1.80	1.81	1.93	1.92	2.00	1.99	1.96	1.98	2.02	1.98	1.99	1.99	2.04	0.05	0.24
	8B	1.80	1.78	1.89	1.88	1.96	1.96	1.95	1.94	1.98	1.95	1.96	1.95	1.97	0.02	0.17
P78*	9A	1.58	1.59	1.73	1.72	1.78	1.80	1.63	1.78	1.81	1.77	1.80	1.82	1.83	0.01	0.25
	9B	1.45	1.45	1.59	1.60	1.66	1.69	1.52	1.66	1.71	1.67	1.69	1.74	1.77	0.03	0.32
P78	10A	1.57	1.59	1.71	1.70	1.74	1.76	1.63	1.74	1.80	1.77	1.78	1.79	1.80	0.01	0.23
	10B	1.59	1.61	1.73	1.73	1.76	1.80	1.66	1.78	1.83	1.79	1.77	1.80	1.80	0.00	0.21
P78*	11A	1.66	1.67	1.80	1.78	1.80	1.84	1.76	1.79	1.82	1.78	1.79	1.80	1.80	0.00	0.14
	11B	1.65	1.67	1.79	1.79	1.80	1.84	1.77	1.80	1.83	1.79	1.80	1.81	1.80	-0.01	0.15
P78*	12A	1.61	1.63	1.74	1.74	1.79	1.76	1.81	1.75	1.76	1.75	1.73	1.77	1.80	0.03	0.19
	12B	1.69	1.70	1.81	1.82	1.87	1.84	1.88	1.84	1.86	1.85	1.86	1.90	1.92	0.02	0.23
P78	13A	1.81	1.82	1.96	1.94	2.00	2.01	1.91	2.00	2.02	1.99	2.01	2.03	2.08	0.05	0.27
	13B	1.81	1.81	1.94	1.93	1.99	2.01	1.91	2.00	2.05	2.00	2.00	2.01	2.08	0.07	0.47
P78	14A	1.73	1.74	-	-	-	-	-	-	-	-	-	-	-	-	-
	14B	1.78	1.79	-	-	-	-	-	-	-	-	-	-	-	-	-
P78	15A	1.95	1.96	2.06	2.05	2.08	2.10	1.94	2.06	2.09	2.06	2.08	2.08	2.11	0.03	0.16
	15B	2.21	2.22	2.33	2.34	2.36	2.38	2.25	2.34	2.38	2.34	2.35	2.35	2.38	0.03	0.17
P78	16A	1.95	1.96	2.06	2.09	2.08	2.11	2.09	2.08	2.12	2.08	2.11	2.11	2.19	0.08	0.24
	16B	1.98	1.99	2.10	2.13	2.17	2.20	2.13	2.17	2.23	2.18	2.22	2.27	2.33	0.06	0.35
P78*	18A	2.03	2.02	2.14	2.13	2.15	2.18	2.05	2.16	2.20	2.16	2.17	2.18	2.18	0.00	0.15
	18B	2.18	2.18	2.30	2.31	2.32	2.35	2.23	2.33	2.37	2.33	2.35	2.36	2.41	0.05	0.23
P78*	19A	2.15	2.15	2.30	2.30	2.32	2.36	2.13	2.30	2.32	2.29	2.34	2.34	2.38	0.04	0.23
	19B	2.15	2.16	2.30	2.29	2.31	2.34	2.11	2.28	2.30	2.28	2.30	2.30	2.31	0.01	0.16
P78	20A	2.00	2.00	2.13	2.12	2.16	2.18	2.04	2.16	2.19	2.16	2.19	2.18	2.22	0.04	0.22
	20B	2.00	2.01	2.11	2.10	2.14	2.18	2.03	2.18	2.24	2.21	2.25	2.28	2.35	0.07	0.35
P79	21A	-	-	-	1.87	1.90	1.95	1.83	1.99	2.00	1.99	2.02	2.04	2.06	0.02	0.19
	21B	-	-	-	1.98	2.01	2.06	1.74	1.90	1.91	1.90	1.96	1.97	2.00	0.03	0.02
P80*	22A	-	-	-	-	2.19	2.17	2.12	1.98	2.01	-	1.99	-	-	-	-
	22B	-	-	-	-	2.01	2.02	1.96	2.14	2.17	-	2.16	-	-	-	-

+ Historical wells.
* New wells - installed and elevations measured on June 11, 1980.
Δ Difference from previous level survey, in metres.
Δ' Difference from original 1978, 1979, or 1980 levels, in metres.

Table III

ASH CELL GROUNDWATER QUALITY - 1985
THUNDER BAY TGS EXTENSION

RELATIVE PIEZOMETER AND LAKE WATER LEVELS - 1985
(Relative to Average Shoreline Level of 182.88 m)

Piezometer Identification	Relative Water Levels in Piezometers (m)		
	Dates Measurements Taken		
	June 17, 1985	Aug. 23, 1985	Sept. 10, 1985
P78 1A	1.06	0.90	0.84
P78 1B	1.15	1.08	1.10
P78 2A	1.14	1.12	1.06
P78 2B	1.15	1.13	1.06
P78 3A	1.12	1.12	1.07
P78 3B	1.12	1.12	1.04
P78 4A	1.11	1.12	1.08
P78 4B	1.10	1.06	1.10
P78 4C	1.09	1.08	1.03
P78 5A	1.04	1.07	1.08
P78 5B	1.07	1.02	1.04
P78 6A	1.06	1.01	1.01
P78 6B	1.05	1.01	1.01
P78 7A	1.06	0.99	1.02
P78 7B	1.07	1.15	1.03
P78 8A	1.07	1.04	1.04
P78 8B	1.08	1.01	1.02
P78 9A	0.75	0.80	0.74
P78 9B	0.74	0.79	0.73
P78 10A	0.90	0.85	0.88
P78 10B	0.90	0.82	0.87
P78 11A	0.90	0.83	0.87
P78 11B	0.89	0.82	0.85
P78 12A	0.89	0.80	-
P78 12B	0.92	0.96	-
P78 13A	0.78	0.87	0.86
P78 13B	0.90	0.86	0.88
P78 14A	-	-	-
P78 14B	-	-	-
P78 15A	0.95	0.86	0.88
P78 15B	0.95	0.91	0.90
P78 16A	0.99	0.94	0.96
P78 16B	1.01	0.97	1.00
P78 17A	-	-	-
P78 17B	-	-	-
P78 18A	1.12	1.00	0.86
P78 18B	1.10	1.07	0.96
P78 19A	0.89	0.91	0.75
P78 19B	1.02	0.92	0.67
P78 20A	1.19	1.11	1.11
P78 20B	1.21	1.14	1.13
P79 21A	0.91	0.90	0.70
P79 21B	0.87	0.91	0.73
P80 22A	1.16*	1.42*	1.14*
P80 22B	1.16*	1.19*	1.12*
Lake Water(1)	0.41	0.55	0.60

(1) Relative Average Monthly Lake Levels (relative to 182.88 m average lake level) for Station 10050, Thunder Bay Harbour. Obtained from Marine Environmental Data, Services Branch, Fisheries and Oceans, Ottawa.

* Based on 1984 reference level.

DAILY MEAN LEVELS — MOYENNES JOURNALIÈRES DES NIVEAUX D'EAU																								
YEAR	MONTH	YEAR	MONTHLY MEANS	DAILY MEANS													HIGH / LOW TIME ZONE EST							
																	H I G H			L O W				
																	INSTANTANEOUS			INSTANTANEOUS				
																	DAY	TIME	MT	DAY	TIME	MT		
1	16	1	85		18311	18313	18313	18310	18312	18311	18310	18309	18310	18309										
1	20	1	85		18308	18309	18311	18303	18308	18310	18307	18305	18303	18303										
1	31	1	85	183072	18303	18304	18306	18306	18302	18307	18304	18306	18306	18305	18304	3	815	18321	14	430	18294			
				(0.192)*																				
1	10	2	85		18304	18304	18303	18303	18303	18302	18301	18300	18302	18303										
1	20	2	85		18300	18299	18298	18298	18302	18303	18302	18300	18302	18304										
1	28	2	85	183022	18304	18303	18302	18302	18306	18301	18304	18306				20	2030	18312	12	1900	18293			
				(0.142)																				
1	10	3	85		18302	18302	18302	18303	18301	18306	18306	18304	18305	18305										
1	20	3	85		18301	18302	18305	18301	18303	18302	18302	18305	18302	18301										
1	31	3	85	183026	18304	18302	18301	18300	18303	18303	18302	18300	18301	18302	18301	4	1700	18315	29	1315	18289			
				(0.146)																				
1	10	4	85		18301	18305	18304	18304	18302	18298	18302	18301	18305	18304										
1	20	4	85		18304	18302	18305	18307	18307	18303	18308	18305	18307	18308										
1	30	4	85	183067	18308	18310	18312	18312	18312	18311	18313	18314	18316	18312		19	430	18323	19	1700	18286			
				(0.187)																				
1	10	5	85		18313	18313	18313	18317	18315	18316	18316	18319	18318	18317										
1	20	5	85		18321	18321	18320	18319	18321	18319	18321	18323	18323	18322										
1	31	5	85	183181	18325	18324	18322	18322	18322	18322	18322	18323	18323	18323	18321	31	545	18334	5	1715	18305			
				(0.313)																				
1	10	6	85		18326	18326	18326	18327	18327	18328	18329	18328	18326	18327										
1	20	6	85		18326	18326	18327	18328	18327	18328	18330	18327	18328	18330										
1	30	6	85	183237	18331	18332	18329	18330	18330	18333	18333	18333	18331	18332		25	2330	18345	9	1730	18316			
				(0.407)																				
1	10	7	85		18333	18332	18333	18336	18332	18333	18336	18335	18333	18333										
1	20	7	85		18334	18335	18334	18334	18334	18334	18336	18337	18336	18338										
1	31	7	85	183357	18336	18337	18339	18340	18339	18339	18340	18339	18338	18339	18338	24	400	18346	4	1130	18324			
				(0.477)																				
1	10	8	85		18339	18340	18340	18340	18341	18341	18339	18340	18342	18340										
1	20	8	85		18341	18345	18346	18343	18342	18342	18346	18345	18342	18342										
1	31	8	85	183627	18343	18343	18345	18345	18345	18346	18345	18345	18346	18344	18346	31	1945	18357	10	1145	18330			
				(0.547)																				
1	10	9	85		18343	18346	18349	18349	18348	18351	18348	18348	18349	18348										
1	20	9	85		18348	18347	18348	18347	18348	18349	18350	18348	18350	18344										
1	30	9	85	183478	18346	18348	18349	18348	18348	18348	18349	18347	18346	18347		6	1500	18363	18	2315	18335			
				(0.598)																				
1	10	10	85																					

Table IV

LAKE SUPERIOR WATER LEVELS - 1985

STATION 10050

THUNDER BAY

Obtained from Marine Environment Data, Services Branch, Fisheries and Oceans, Ottawa, Ontario, Canada

*( ) These values are the difference between the monthly means and the average shoreline level of 182.88 m)

2. Groundwater Levels

The piezometer groundwater level data acquired in 1985 (Table III) show that groundwater levels in the ash cell area varied from lows of 0.67 m above the average shoreline water level of 182.88 m (reference level), in piezometer 19B on September 10, 1985, to a high of 1.42 m above the average shoreline level, in piezometer 22A on August 23, 1985. Other high levels (>1.00 m) occurred in piezometers 01A to 08B, 16B, 18A, 18B, 20A, 20B, 22A and 22B. It appears, therefore, that high groundwater levels exist at the north west and south sides of the ash cell.

The relationships between groundwater levels in several selected piezometers, lake water levels and total weekly precipitation, presented in Figure 2, show that groundwater levels were generally higher at the start of the survey in June and then gradually decreased to their lower levels in September. This pattern of groundwater level changes was also evident in the data acquired in previous years. Because groundwater levels were not measured before June the effect of low precipitation on groundwater levels during that period is not known.

3. Groundwater Quality

The data on the chemical characteristics of the groundwaters sampled in 1985 are summarized in Appendix A. The main chemical characteristics of the groundwaters from selected locations surrounding the ash cell are discussed below.

(a) pH Levels

A summary of the 1985 pH levels in the groundwaters from the ash storage area is shown in Table V. Figure 3 shows a plot of pH levels in waters from six selected piezometers, from 1978 through 1985.

During 1985, the pH levels of the groundwaters examined at Research, ranged from a low of 6.4 from piezometer 16 A on June 6, to a high of 8.0, from piezometer 09A on September 13. The remaining pH levels were between these two and are essentially the same for both sampling dates. The pH levels obtained in the field are slightly lower. They range between 6.1 and 7.0. The 1985 pH levels resemble those obtained during the previous years' surveys and those commonly associated with natural surface waters.

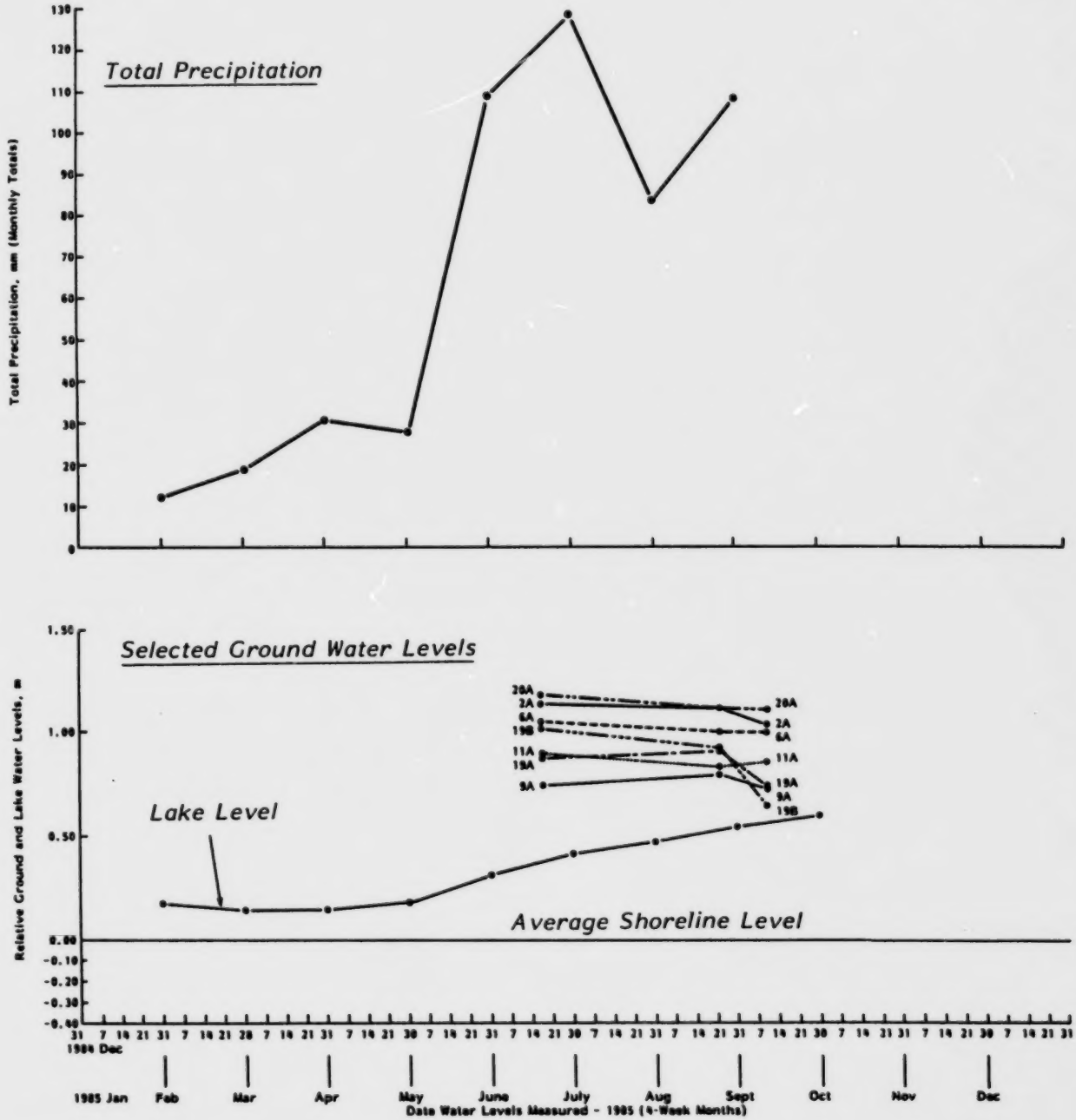

FIGURE 2

ASH CELL GROUND AND LAKE WATER LEVELS (m)* AND TOTAL PRECIPITATION (mm)

***(Relative to Average Lake Shoreline Level of 182.88 m)**

TABLE V
ASH CELL AREA GROUNDWATER QUALITY TBTGS - 1985

Test:pH

Location	Sampling Date			
	850608	850609*	850913	850914*
01A	6.8	6.6	7.1	6.6
01B	7.5	6.6	7.3	6.4
02A	7.1	6.5	7.0	6.5
02B	7.2	6.5	7.1	6.3
03A	7.3	6.7	7.1	6.7
03B	7.4	6.6	7.0	6.4
04A	7.2	6.6	7.1	6.5
04B	7.8	6.5	7.3	6.4
04C	7.2	6.6	6.9	6.5
05A	6.7	6.5	6.6	6.4
05B	7.3	6.5	7.3	6.3
06A	7.0	6.5	6.9	6.5
06B	7.7	6.5	7.3	6.4
07A	6.9	6.5	6.9	6.4
07B	7.4	6.6	7.1	6.4
08A	6.7	6.5	6.8	6.4
08B	7.6	6.7	7.8	6.7
09A	6.9	6.5	8.0	6.4
09B	7.1	6.3	7.1	6.1
10A	7.0	6.7	7.5	6.3
10B	7.4	6.5	7.3	6.2
11A	6.9	6.5	7.1	6.4
11B	7.6	6.5	7.1	6.3
12A	7.0	6.6	--	--
12B	6.9	6.5	--	--
13A	6.9	6.4	6.8	6.3
13B	7.2	6.2	6.8	6.1
15A	6.7	6.5	6.7	6.5
15B	6.8	6.4	6.6	6.1
16A	6.4	6.3	6.5	6.2
16B	7.5	6.4	7.2	6.2
18A	7.3	6.5	7.3	6.4
18B	7.8	6.9	7.7	7.0
19A	7.7	6.6	7.3	6.4
19B	7.5	6.3	7.4	6.9
20A	6.9	6.4	7.1	6.2
20B	7.0	6.1	6.8	6.2
21A	7.8	6.4	7.1	6.4
21B	7.8	6.1	7.0	6.7
22A	7.1	6.7	7.3	6.7
22B	7.7	6.5	7.3	6.1

*TBTGS data obtained on fresh samples taken on the day before that shown. This is to avoid confusion in data input to computer.

TBTGS ASH - SELECTED BOREHOLES

pH (Lab) vs TIME

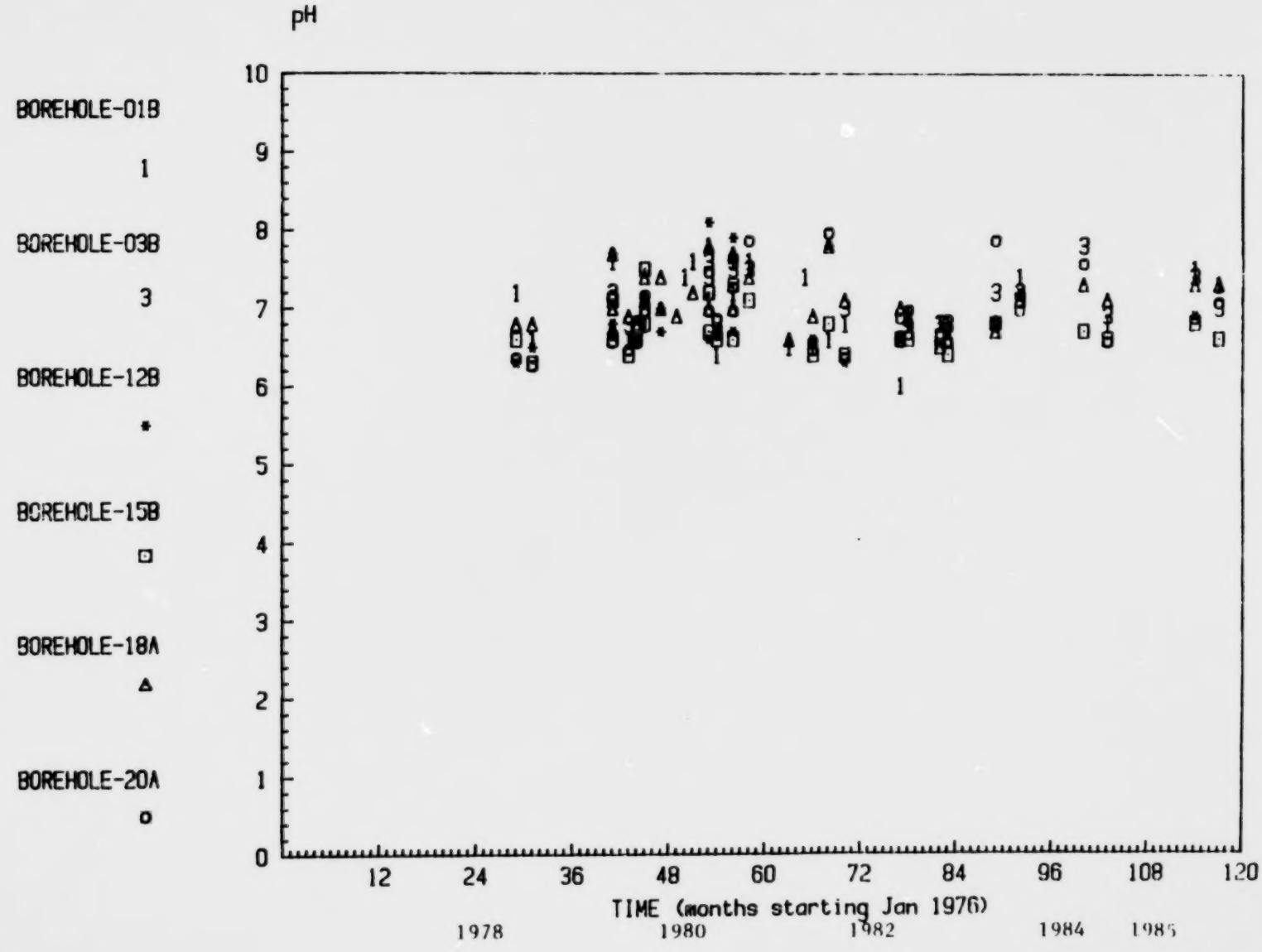

FIGURE 3

The summary plot in Figure 3 shows no significant changes in pH levels of the groundwaters sampled since 1978. The plot (Figure 3) again indicates that no location shows unusually high pH values that could be considered indicative of leachate formation.

(b) Alkalinity

A summary of 1985 bicarbonate alkalinity (HCO_3 as $CaCO_3$) data on the groundwaters from the ash area is shown in Table VI. Figure 4 shows a plot of alkalinity levels of waters from six selected piezometers from 1978 through 1985.

The 1985 alkalinity levels of the groundwaters examined at Research varied somewhat. They ranged from lows of 96 and 98 mg/L, as $CaCO_3$, in the June and September samples from piezometer 19B, to a high of 730 and 720 mg/L in the September and June samples from piezometers 06B and 12A. In general, low (<200 mg/L) alkalinity levels were present in waters from piezometers 19A, 19B, 21A and 21B. These piezometers are all located on the north side of the ash cell. Higher (>500 mg/L) alkalinity levels were present in waters from piezometers 01A, 01B, 02B, 03B, 04B, 06A, 06B, 07B, 08A, 08B, 11B, 12A, 12B, 20A, 20B, 22A and 22B. With the exception of piezometer 12A and 12B all other piezometers are located close to and around the entire ash cell.

As observed previously, the alkalinity values obtained at TBTGS on fresh water samples are somewhat higher than those obtained at Research. This is probably due to normal changes in the chemical equilibrium of the water caused by changes in the water's temperature, dissolved gases and other chemical reactions.

With the exception of the high alkalinities observed in waters sampled in 1979 (Figure 4) the alkalinity levels during the subsequent years, 1980 to 1985, were relatively stable. As stated in Research Report 84-108 the high 1979 alkalinity levels coincided with the start of placement of wet (leached 2) bottom ash and fly ash from Unit #1. These high values were temporary and dropped suddenly in the latter part of 1979 and remained stable ever since.

Both, the data shown in Table VI and in Figure 4 show that no unusual changes occured in alkalinity levels in the groundwater in 1985.

TABLE VI

ASH CELL AREA GROUNDWATER QUALITY TBTGS - 1985

Test: ALK HCO_3 mg/L as $CaCO_3$

Location	Sampling Date			
	850608	850609*	850913	850914*
01A	440	540	560	350
01B	500	550	520	540
02A	470	530	470	540
02B	470	610	530	670
03A	490	560	490	530
03B	510	640	600	650
04A	340	420	340	420
04B	510	550	430	450
04C	280	340	330	450
05A	340	530	310	560
05B	280	370	440	530
06A	570	740	580	770
06B	630	710	730	800
07A	410	510	430	620
07B	440	530	510	660
08A	490	670	600	730
08B	420	490	610	580
09A	280	350	280	450
09B	250	310	250	270
10A	400	460	400	520
10B	420	520	460	500
11A	410	520	400	450
11B	500	640	420	470
12A	720	920	--	--
12B	510	600	--	--
13A	270	410	280	370
13B	300	400	270	340
15A	350	600	360	520
15B	450	600	330	410
16A	290	470	250	420
16B	320	340	280	320
18A	320	330	350	400
18B	270	280	360	400
19A	200	260	190	250
19B	96	120	98	160
20A	490	560	510	590
20B	510	530	530	590
21A	180	200	140	210
21B	160	150	140	170
22A	550	620	530	620
22B	600	670	650	680

*TBTGS data obtained on fresh samples taken on the day before that shown. This is to avoid confusion in data input to computer.

TBTGS ASH - SELECTED BOREHOLES

HCO3 ALKALINITY (LAB) vs TIME

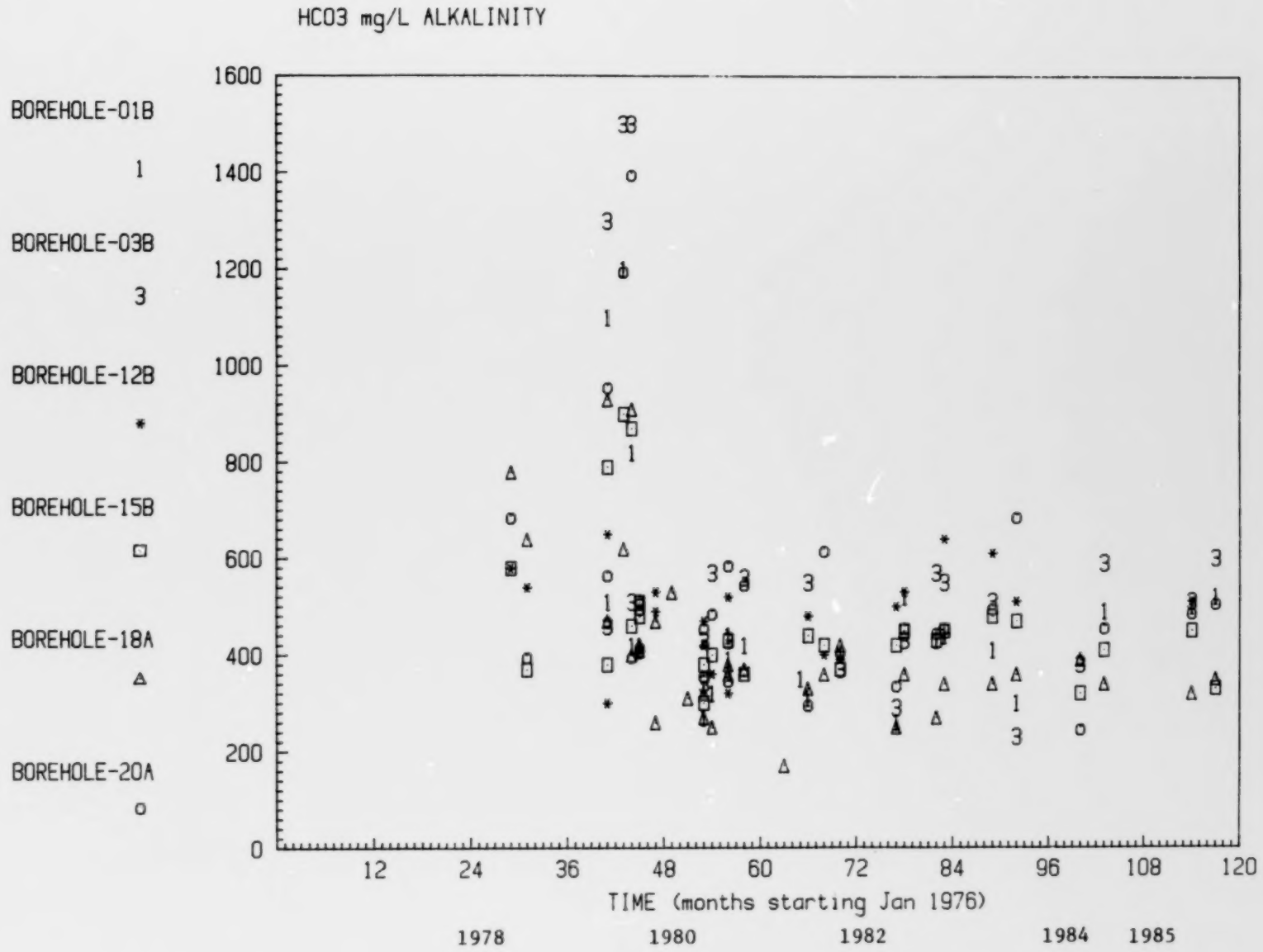

FIGURE 4

(c) Sulphate Levels

A summary of the 1985 data on sulphate levels in the groundwaters examined is shown in Table VII. Figure 5 shows a plot of SO_4 levels in waters from six selected piezometers from 1978 through 1985.

Waters from most locations had relatively low (<50 mg/L) sulphate levels. Again the lowest levels were present in waters from piezometers located mainly along the south and east sides, where least amount of ash has been placed.

Higher (>50 mg/L) sulphate levels were found in groundwaters from piezometers 01A, 03B, 05A, 11A, 11B, 15B, 16A, 16B, 20A and 20B, most located close to and on the north east and west sides of the ash cell where most ash is piled. As was mentioned in previous reports sulphate levels can be increased by local biological activity in the groundwater and this is probably the cause of some of the higher values present.

Comparison of the SO_4 concentrations in groundwaters from some selected piezometers from 1978 through 1985, as shown in Figure 5, shows that the 1985 SO_4 concentrations varied as in previous years.

(d) Sodium Levels

A summary of the 1985 data on sodium levels in the groundwaters examined is shown in Table VIII. Figure 6 shows a summary of Na levels in waters from six selected piezometers from 1978 through 1985.

During 1985 sodium levels were present in a narrow range. They ranged from a low of 6.9 mg/L in June, in water from piezometer 03B, located on the west side of the ash cell, to a high of 62 mg/L in September in water from piezometer 08B, located on the southeast corner of the pile. These sodium levels are not considered to be indicative of any significant leachate.

Both the data shown in Table VIII and in Figure 6 show that no significant changes occurred in sodium levels in the groundwater in 1985.

(e) Magnesium Levels

A summary of the 1985 magnesium levels in the groundwaters examined is shown in Table IX. Figure 7 shows a summary of Mg levels in waters from six selected piezometers, from 1978 through 1985.

TABLE VII

ASH CELL AREA GROUNDWATER QUALITY TBTGS - 1985

TEST: SO_4 mg/L

Location	Sampling Date	
	850608	850913
01A	69	64.
01B	6.6	5.0
02A	18	19.
02B	32	18.
03A	1.8	2.3
03B	2.2	87.
04A	.5	1.2
04B	1.2	1.6
04C	1.2	5.9
05A	140.	160.
05B	7.7	21.
06A	<.5	0.7
06B	0.8	0.6
07A	0.5	<0.5
07B	0.5	0.5
08A	0.6	<0.5
08B	0.7	1.1
09A	0.8	1.1
09B	0.9	30
10A	28	30
10B	36	36
11A	74	85
11B	92	87
12A	<0.5	--
12B	<0.5	--
13A	11.	13
13B	4.6	4.7
15A	24	32
15B	92	140
16A	140	160
16B	24	140
18A	71	27
18B	7.0	26
19A	16	7.9
19B	17	14
20A	130	240
20B	130	210
21A	16	15.
21B	4.6	6.7
22A	21	21
22B	14	6.1

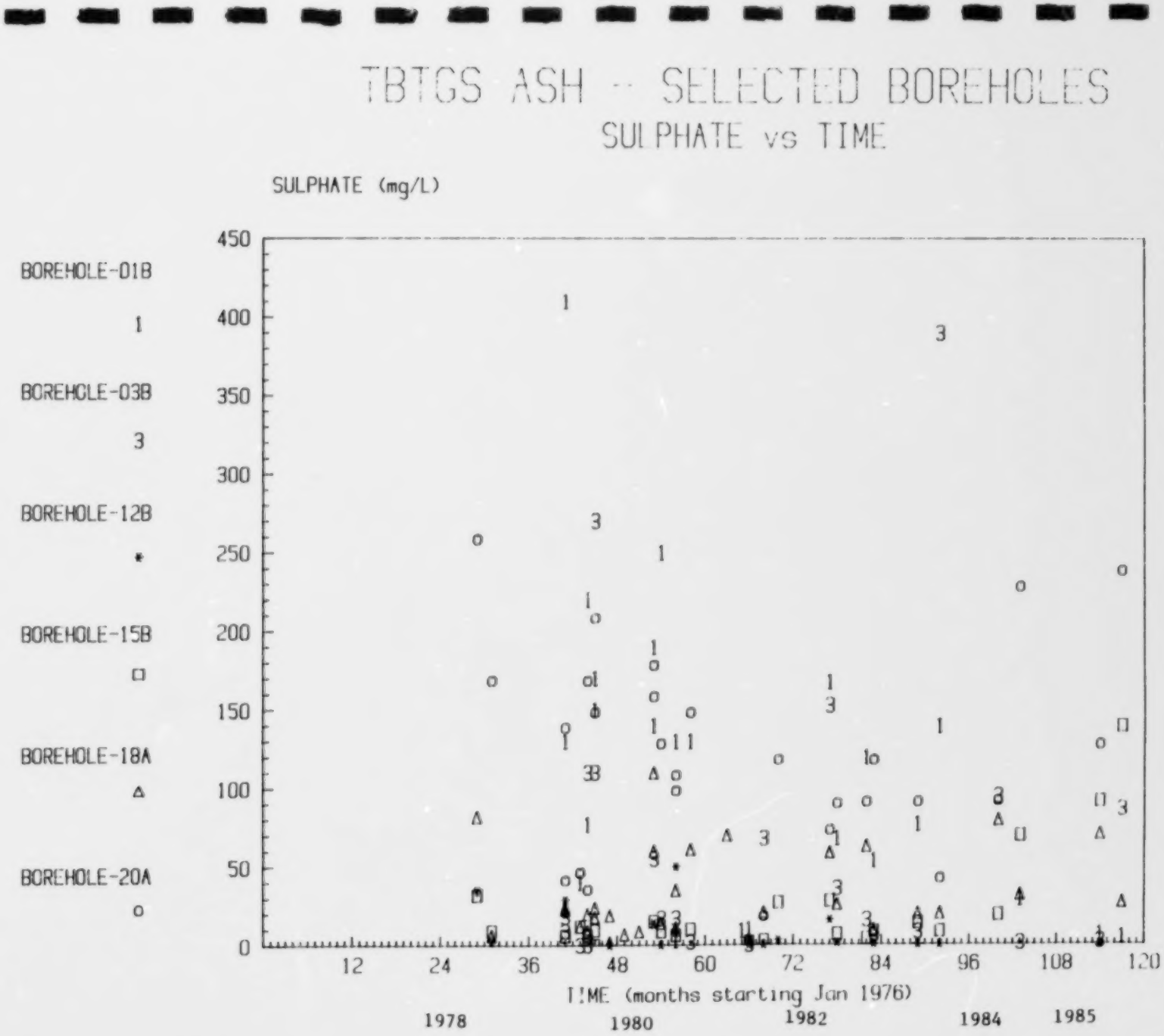
TBTGS ASH -- SELECTED BOREHOLES
SULPHATE vs TIME
SULPHATE (mg/L)
BOREHOLE-01B
BOREHOLE-03B
BOREHOLE-12B
BOREHOLE-15B
BOREHOLE-18A
BOREHOLE-20A
450
400
350
300
250
200
150
100
50
0
12
24
36
48
60
72
84
96
108
120
TIME (months starting Jan 1976)
1978
1980
1982
1984
1985

FIGURE 5

TABLE VIII

ASH CELL AREA GROUNDWATER QUALITY TBTGS - 1985

TEST: Na mg/L

Location	Sampling Date	
	850608	850913
01A	17	20
01B	18	19
02A	15	14
02B	13	8.8
03A	21	24
03B	6.9	13
04A	17.	18
04B	40.	19
04C	9.5	12
05A	22	14
05B	12	18
06A	19	16
06B	11	12
07A	15	14
07B	10	10
08A	10	12
08B	26	62
09A	13	13
09B	14	11
10A	14	17
10B	13	15
11A	16	14
11B	13	16
12A	21	--
12B	11	--
13A	9.5	7.3
13B	13	12
15A	13	16
15B	13	16
16A	34	43
16B	12	20
18A	11	13
18B	10	10
19A	7.7	8.0
19B	8.1	10
20A	24	32
20B	22	27
21A	7.4	7.9
21B	10	6.9
22A	38	45
22B	39	28

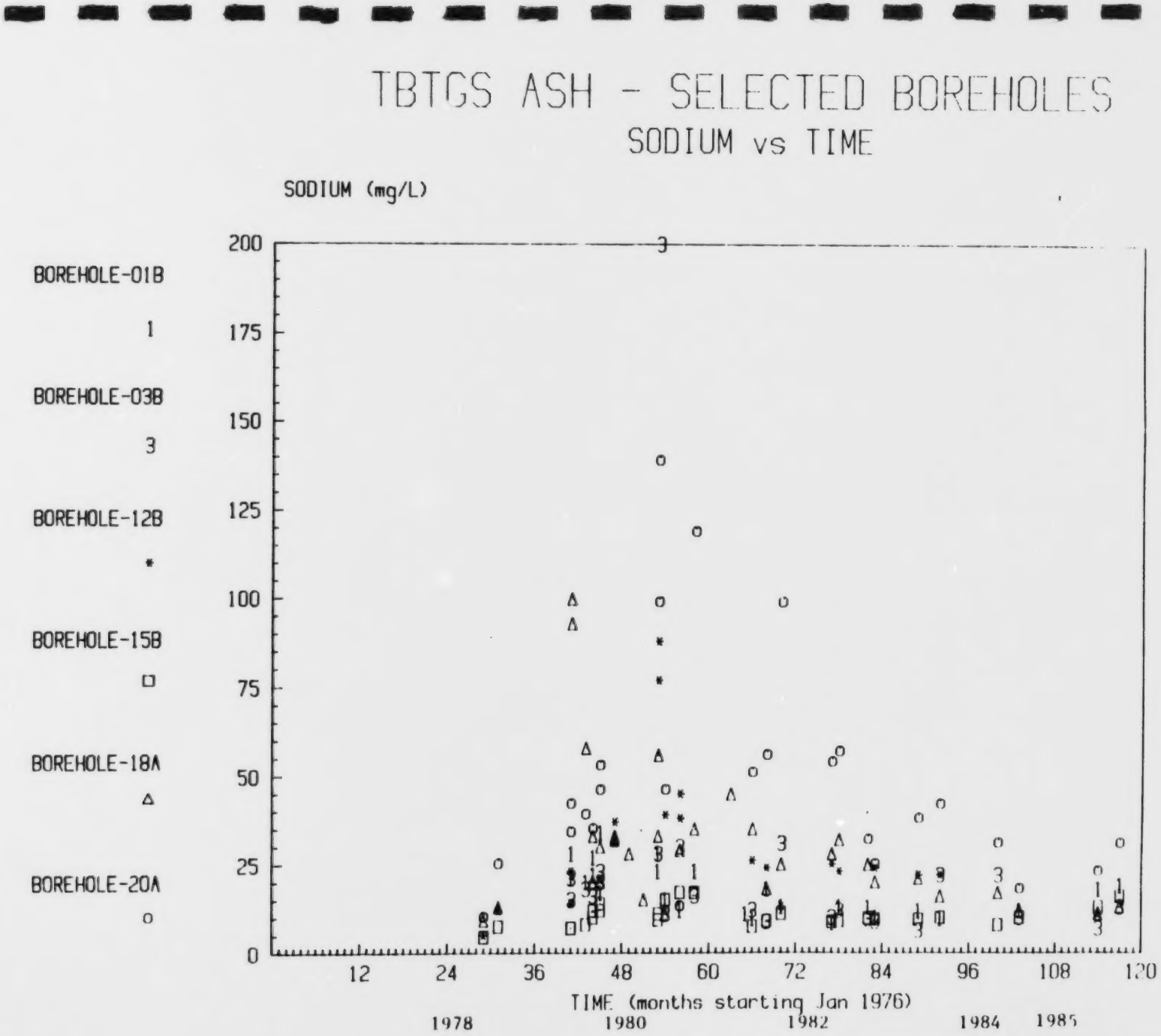
TBTGS ASH - SELECTED BOREHOLES
SODIUM vs TIME
SODIUM (mg/L)
BOREHOLE-01B
1
BOREHOLE-03B
3
BOREHOLE-12B
*
BOREHOLE-15B
□
BOREHOLE-18A
Δ
BOREHOLE-20A
o
200
175
150
125
100
75
50
25
0
12
24
36
48
60
72
84
96
108
120
TIME (months starting Jan 1976)
1978
1980
1982
1984
1985

FIGURE 6

The 1985 magnesium levels were present in a relatively narrow range. They range from a low of about 11 mg/L in water from piezometer 19B, located on the north side of the ash cell, to a high of 84 mg/L in September in water from piezometer 06B located on the south side of the cell. There is no significant overall difference in Mg levels in the waters sampled on different dates.

Low (<20 mg/L) magnesium levels were present in waters from piezometer nests 19 and 21 on the north side and some distance away from the ash cell. The highest (>50 mg/L) magnesium levels were present in waters from piezometer nests 1,6,8,11,12,15,20 and 22. With the exception of piezometer nest 12 the rest of the piezometers are close to and around the entire perimeter of the ash cell.

As shown in Figure 7, the 1985 Mg levels in waters from six selected piezometers are somewhat higher than they were in some preceding years (1980-84). However, during 1978 and 1979 some waters also contained significantly higher Mg levels. These Mg levels could be regarded as representing normal natural groundwater quality in the area.

(f) Boron and Strontium Levels

Summaries of the 1985 data on the boron and strontium levels in the groundwaters examined are shown in Tables X and XI. Figures 8 and 9 show B and Sr levels, respectively, in waters from six selected piezometers from 1978 through 1985.

Boron levels in 1985 ranged from their detection limit of 0.05 mg/L, in waters from piezometers, 09A and 19B, furthest away from the ash, to a high of 3.6 mg/L in waters from piezometer 16A at the north side of the pile. Other higher B levels were found in piezometers 16B, 20A and 20B also on the north side of the pile. Again it is observed, that somewhat relatively higher boron levels (>0.2 mg/L) were present in the September water samples when groundwater levels were lower.

Strontium levels ranged from a low of 0.05 mg/L in piezometer 19B in the September sample to a high of 0.81 mg/L in piezometer 22A in the June sample.

For comparison purposes, boron and strontium levels in waters from six selected locations are shown in Figures 8 and 9. It is evident that the 1985 boron levels from piezometers 20A are somewhat higher than the 1984 levels and about similar to those present in the waters sampled in 1982. The 1985 strontium levels are essentially unchanged from the previously obtained levels.

TABLE IX

ASH CELL AREA GROUNDWATER QUALITY TRENDS - 1985

TEST: Mg mg/L

Location	Sampling Date	
	850608	850913
01A	49	55
01B	75	61
02A	43	45
02B	42	48
03A	38	41
03B	49	64
04A	30	27
04B	35	33
04C	23	27
05A	46	47
05B	29	44
06A	52	38
06B	75	84
07A	45	44
07B	47	49
08A	56	59
08B	44	52
09A	30	28
09B	24	23
10A	44	43
10B	49	48
11A	50	37
11B	65	52
12A	73	--
12B	50	--
13A	31	22
13B	38	29
15A	42	42
15B	66	44
16A	39	32
16B	23	31
18A	27	31
18B	19	28
19A	16	16
19B	11	11
20A	62	74
20B	60	68
21A	20	16
21B	17	14
22A	51	50
22B	61	65

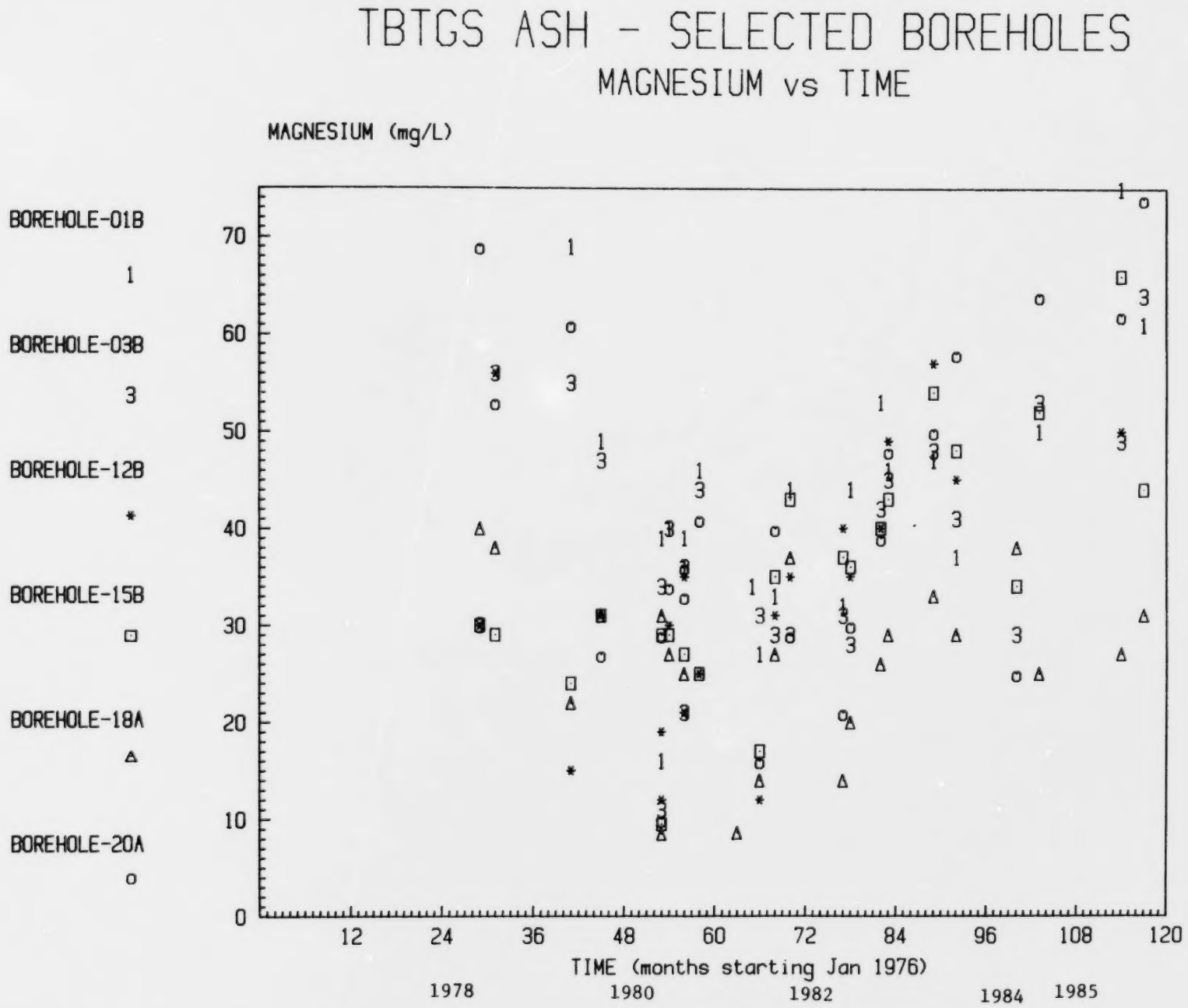
TBTGS ASH - SELECTED BOREHOLES
MAGNESIUM vs TIME
MAGNESIUM (mg/L)
BOREHOLE-01B
1
BOREHOLE-03B
3
BOREHOLE-12B
*
BOREHOLE-15B
□
BOREHOLE-18A
△
BOREHOLE-20A
o
0
10
20
30
40
50
60
70
12
24
36
48
60
72
84
96
108
120
TIME (months starting Jan 1976)
1978
1980
1982
1984
1985

FIGURE 7

TABLE X

ASH CELL AREA GROUNDWATER OUALITY TBTGS - 1985

TEST: B mg/L

Location	Sampling Date	
	850608	850913
01A	0.14	0.26
01B	0.34	0.46
02A	0.11	0.12
02B	0.15	0.17
03A	0.08	0.07
03B	0.19	0.27
04A	0.10	0.08
04B	0.14	0.15
04C	0.09	0.07
05A	0.08	0.06
05B	0.11	0.10
06A	0.11	0.11
06B	0.15	0.20
07A	0.06	0.10
07B	0.10	0.10
08A	0.23	0.23
08B	0.11	0.17
09A	0.06	0.08
09B	0.06	0.07
10A	0.09	0.12
10B	0.09	0.13
11A	0.10	0.21
11B	0.10	0.22
12A	0.24	--
12B	0.15	--
13A	0.13	0.12
13B	0.15	0.13
15A	0.09	0.09
15B	0.19	0.10
16A	2.8	3.6
16B	0.61	1.8
18A	0.43	0.49
18B	0.45	0.42
19A	<.05	<.05
19B	<.05	<.05
20A	1.4	1.8
20B	0.99	1.3
21A	0.07	0.06
21B	0.52	0.42
22A	0.15	0.18
22B	0.31	0.44

TBTGS ASH - SELECTED BOREHOLES

BORON vs TIME

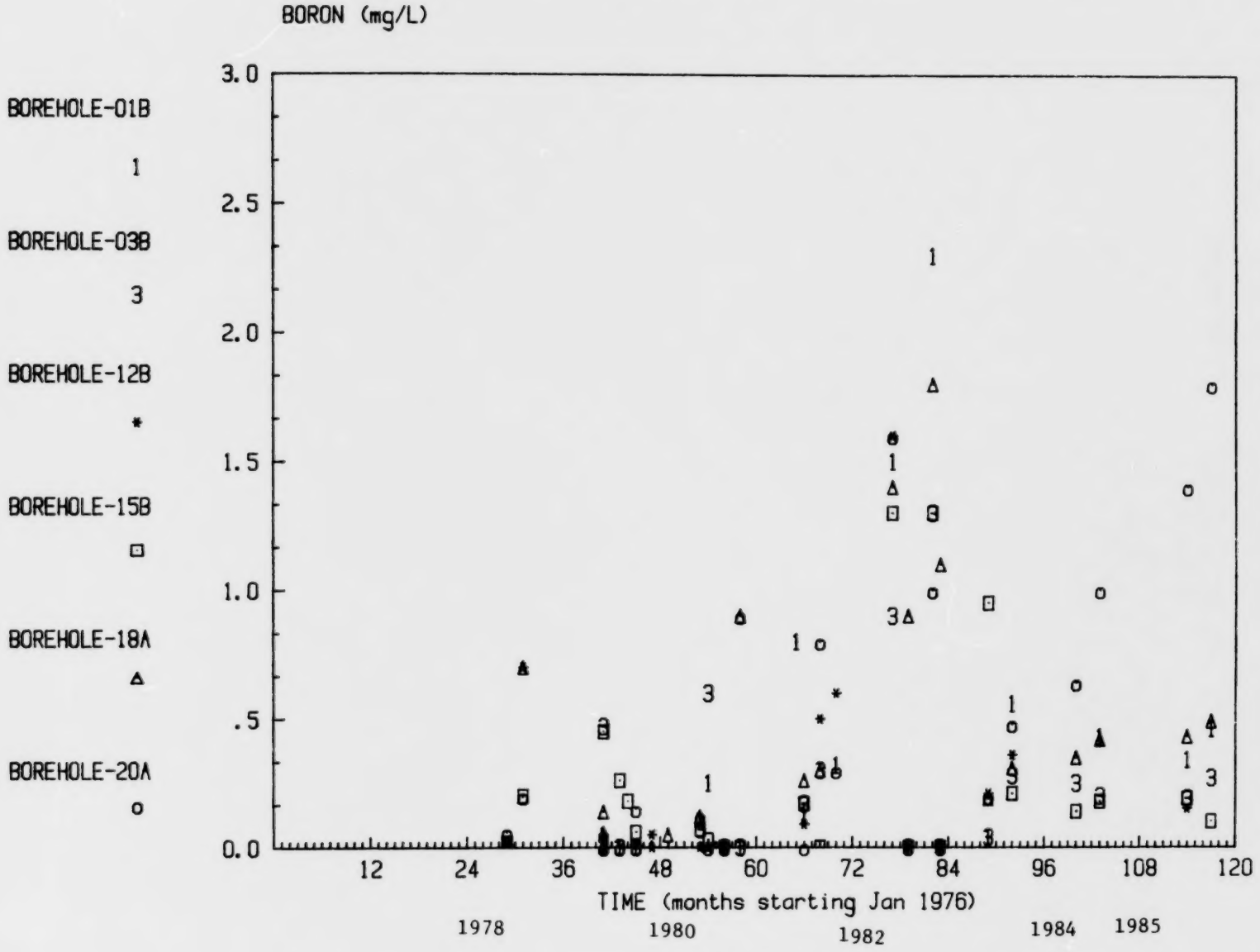

FIGURE 8

TABLE XI

ASH CELL AREA GROUNDWATER OUALITY TBTGS - 1985

TEST: Sr mg/L

Location	Sampling Date	
	850608	850913
01A	0.31	0.26
01B	0.35	0.37
02A	0.20	0.16
02B	0.22	0.19
03A	0.20	0.24
03B	0.24	0.27
04A	0.19	0.15
04B	0.62	0.48
04C	0.15	0.15
05A	0.23	0.19
05B	0.21	0.27
06A	0.32	0.28
06B	0.32	0.35
07A	0.36	0.25
07B	0.26	0.26
08A	0.18	0.18
08B	0.20	0.39
09A	0.15	0.13
09B	0.11	0.09
10A	0.20	0.20
10B	0.20	0.16
11A	0.31	0.20
11B	0.30	0.24
12A	0.54	--
12B	0.45	--
13A	0.18	0.10
13B	0.14	0.07
15A	0.20	0.24
15B	0.24	0.17
16A	0.26	0.19
16B	0.40	0.16
18A	0.52	0.42
18B	0.16	0.21
19A	0.11	0.10
19B	0.06	0.05
20A	0.26	0.25
20B	0.25	0.25
21A	0.12	0.08
21B	0.20	0.14
22A	0.81	0.31
22B	0.26	0.23

TBTGS ASH -- SELECTED BOREHOLES

STRONTIUM vs TIME

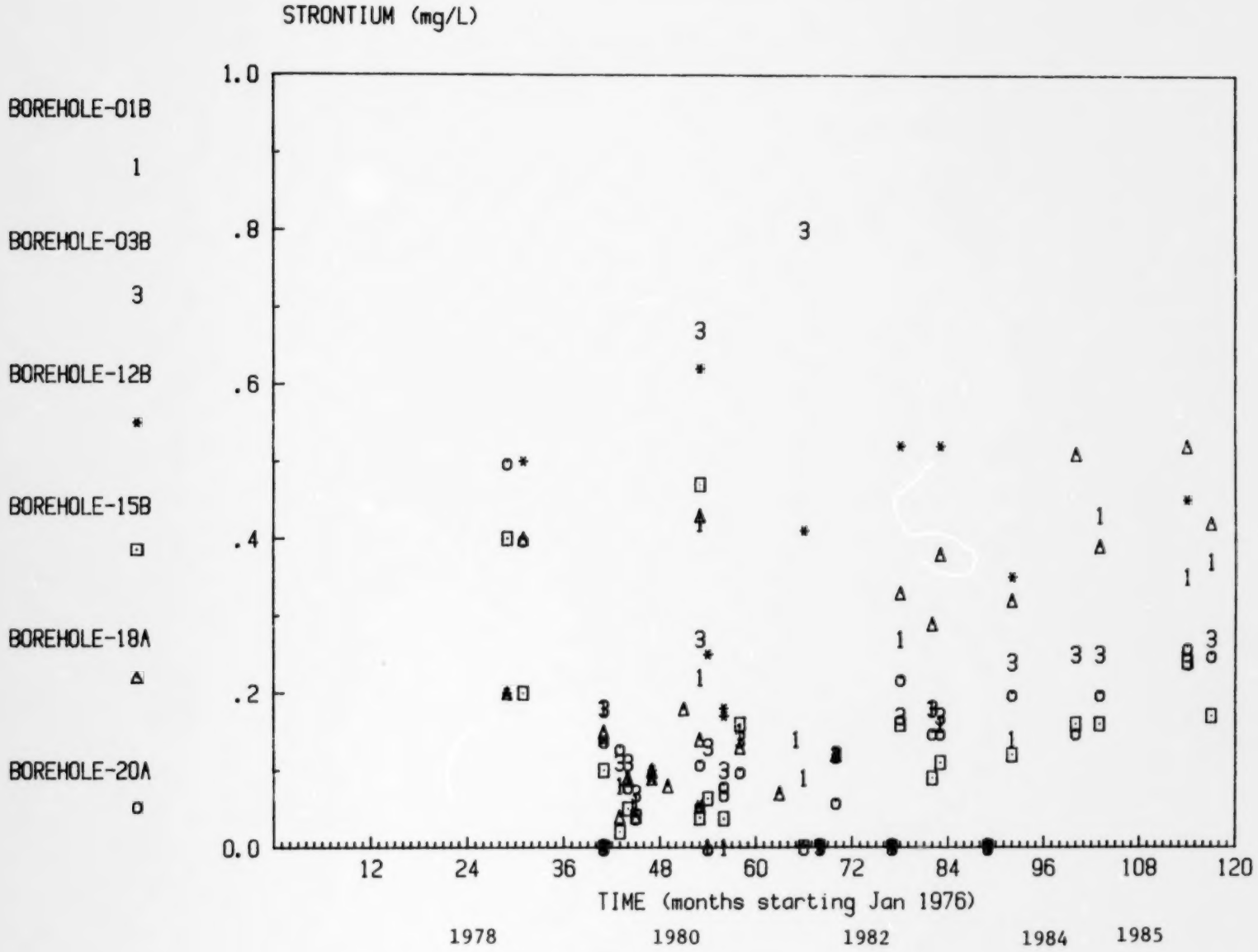

FIGURE 9

The high (2.8 and 3.6 mg/L) boron levels in the groundwater from piezometer 16A are unusual and should be watched in the future.

(h) Piper Plots

The 1985 data, as represented by the Piper Plots in Figures 10 and 11, show that all of the groundwaters in the vicinity of the ash storage area resemble natural surface or groundwaters. In these types of waters, the alkaline earth cations (Ca and Mg) and the weak acid anions (HCO_3 and CO_3) predominate. There is an indication this year that waters from piezometers, such as 03B, 16A and 16B, that contained higher than normal SO_4 concentrations (>200 mg/L) in 1984 have improved.

CONCLUSIONS

As observed in the previous years, the 1985 data also show that groundwater level changes are not influenced by changes in lake water levels.

The 1985 data on the groundwater characteristics show an improvement in general water quality at all sampling locations.

Although in general the 1985 boron levels were similar to those present in the previous years, higher than normal levels were found in waters from piezometer 16A located at the northwest corner of sub-cell 3. This situation should be watched during the next monitoring period.

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MAJOR ION CHEMISTRY
TBTGS ASH
JUNE 08 1985
TYPE - WATER
ASH CELL GROUNDWATER QUALITY - 1985

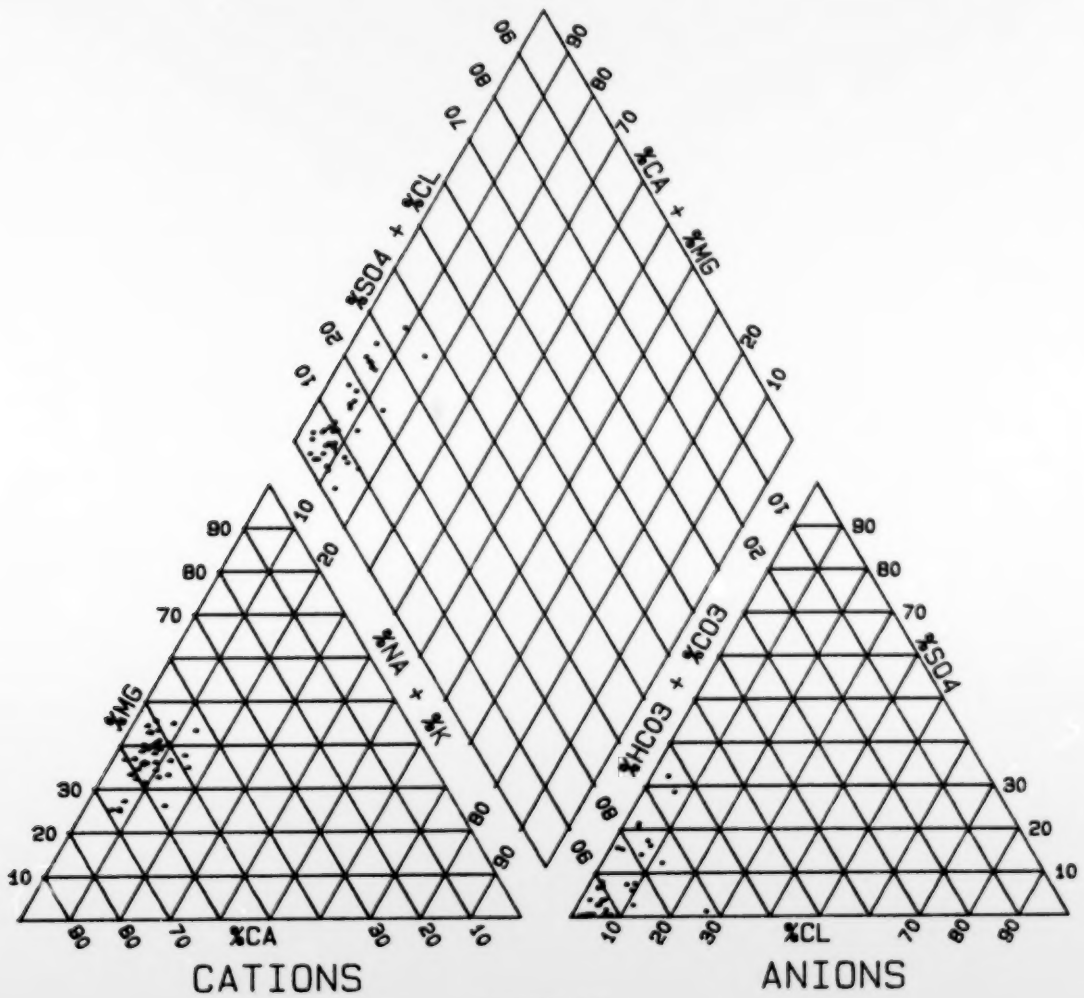

FIGURE 10

MAJOR ION CHEMISTRY
TBTGS ASH
SEPT 13 1985
TYPE - WATER
ASH CELL GROUNDWATER QUALITY - 1985

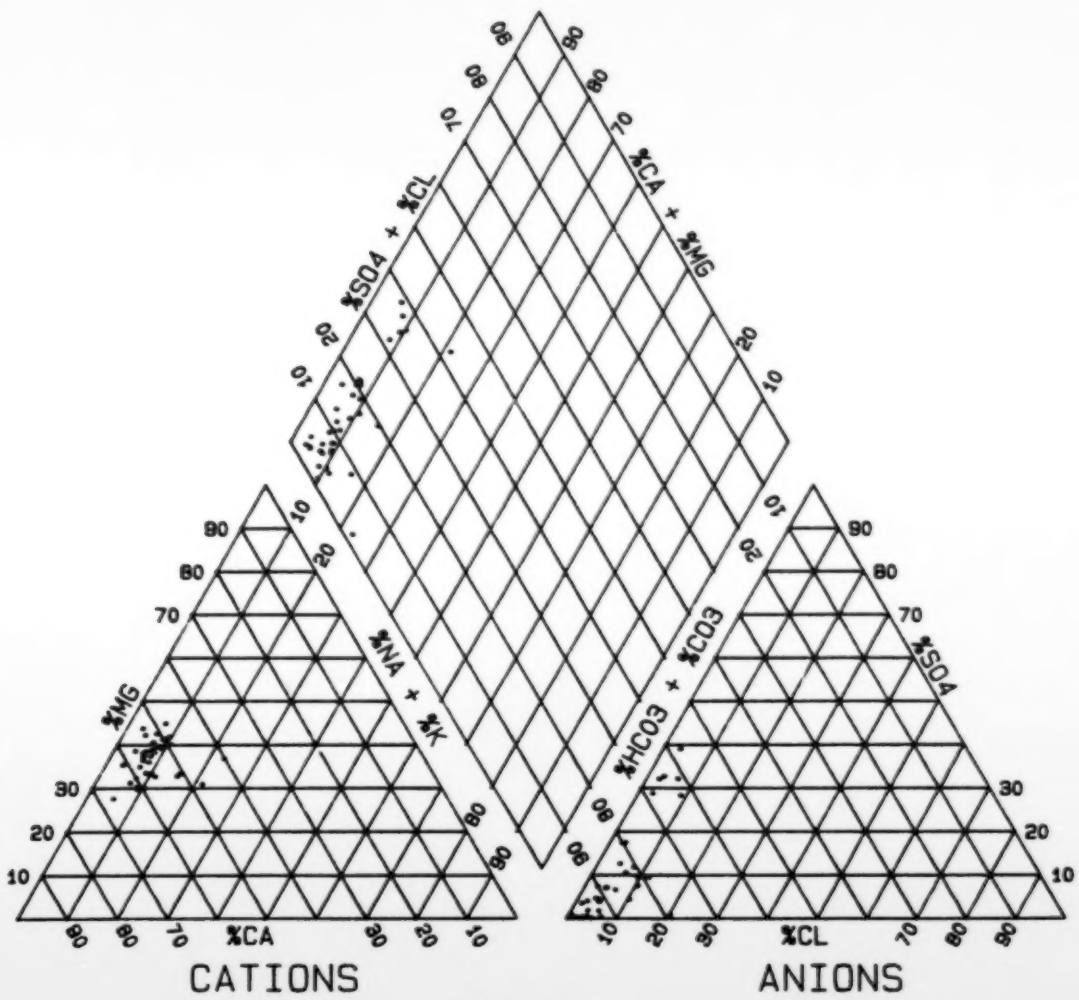

FIGURE 11

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APPENDIX A

ASH CELL
GROUNDWATER CHEMICAL ANALYSIS - TBTGS - 1985

(All values are in mg/L except pH and conductivity

- pH in pH units
- conductivity in mS/m

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 01A

TEST	850608	850609 *	850913	850914*
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	440.	540.	560.	350.
ALKOH	<5.0	--	<5.0	--
B	.14	--	.26	--
CA	140.	--	140.	--
CL	52.		60.	--
COND	100.	100.	120.	72.
K	1.5	--	1.7	--
MG	49.	--	55.	--
NA	17.	--	20.	
PH	6.8	6.6	7.1	6.6
SO4	69.	--	64.	--
SR	.31	--	.26	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 01B

TEST	850608	850609 *	850913	850914 *
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	500.	550.	520.	540.
ALKOH	<5.0	--	<5.0	--
B	.34	--	.46	--
CA	180.	--	140.	--
CL	130.	--	95.	--
COND	120.	120.	120.	110.
K	2.0	--	2.0	--
MG	75.	--	61.	--
NA	18.	--	19.	--
PH	7.5	6.6	7.3	6.4
SO4	6.6	--	5.0	--
SR	.35	--	.37	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 02A

TEST	850608	850609 *	850913	850914*
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	470.	530.	470.	540.
ALKOH	<5.0	--	<5.0	--
B	.11	--	.12	--
CA	110.	--	110.	--
CL	7.6	--	8.3	--
COND	86.	90.	84.	90.
K	1.2	--	1.4	--
MG	43.	--	45.	--
NA	15.	--	14.	--
PH	7.1	6.5	7.0	6.5
SO4	18.	--	19.	--
SR	.20	--	.16	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 02B

TEST	850608	850609 *	850913	850914 *
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	470.	610.	530.	670.
ALKOH	<5.0	--	<5.0	--
B	.15	--	.17	--
CA	130.	--	140.	--
CL	9.0	--	5.8	--
COND	84.	110.	92.	92.
K	1.0	--	.93	--
MG	42.	--	48.	--
NA	13.	--	8.8	--
PH	7.2	6.5	7.1	6.3
SO4	32.	--	18.	--
SR	.22	--	.19	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 03A

TEST	850608	850609*	850913	850914*
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	490.	560.	490.	530.
ALKOH	<5.0	--	<5.0	--
B	.080	--	.070	--
CA	120.	--	110.	--
CL	12.	--	14.	--
COND	80.	97.	86.	88.
K	1.3	--	1.3	--
MG	38.	--	41.	--
NA	21.	--	24.	--
PH	7.3	6.7	7.1	6.7
SO4	1.8	--	2.3	--
SR	.20	--	.24	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 03B

TEST	850608	850609*	850913	850914*
			SAMPLING DATE	
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	510.	640.	600.	650.
ALKOH	<5.0	--	<5.0	--
B	.19	--	.27	--
CA	130.	--	180.	--
CL	17.	--	24.	--
COND	87.	110.	120.	110.
K	1.0	--	1.1	--
MG	49.	--	64.	--
NA	6.9	--	13.	--
PH	7.4	6.6	7.0	6.4
SO4	2.2	--	87.	--
SR	.24	--	.27	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 04A

TEST	850608	850609*	850913	850914*
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	340.	420.	340.	420.
ALKOH	<5.0	--	<5.0	--
B	.10	--	.080	--
CA	80.	--	78.	--
CL	8.6	--	9.6	--
COND	62.	73.	61.	70.
K	1.0	--	1.1	--
MG	30.	--	27.	--
NA	17.	--	18.	--
PH	7.2	6.6	7.1	6.5
SO4	.50	--	1.2	--
SR	.19	--	.15	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 04B

TEST	850608	850609*	850913	850914*
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	510.	550.	430.	450.
ALKOH	<5.0	--	<5.0	--
B	.14	--	.15	--
CA	130.	--	110.	--
CL	38.	--	22.	--
COND	88.	100.	79.	78.
K	2.1	--	1.5	--
MG	35.	--	33.	--
NA	40.	--	19.	--
PH	7.8	6.5	7.3	6.4
SO4	1.2	--	1.6	--
SR	.62	--	.48	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 04C

TEST	850608	850609 *	850913	850914 *
		SAMPLING DATE		
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	280.	340.	330.	450.
ALKOH	<5.0	--	<5.0	--
B	.090	--	.070	--
CA	71.	--	84.	--
CL	8.6	--	8.8	--
COND	52.	55.	61.	72.
K	.90	--	1.3	--
MG	23.	--	27.	--
NA	9.5	--	12.	--
PH	7.2	6.6	6.9	6.5
SO4	1.2	--	5.9	--
SR	.15	--	.15	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 05A

TEST	SAMPLING DATE 850608	850609 *	850913	850914 *
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	340.	530.	310.	560.
ALKOH	<5.0	--	<5.0	--
B	.080	--	.060	--
CA	110.	--	110.	--
CL	25.	--	23.	--
COND	85.	110.	86.	110.
K	.90	--	1.0	--
MG	46.	--	47.	--
NA	22.	--	14.	--
PH	6.7	6.5	6.6	6.4
SO4	140.	--	160.	--
SR	.23	--	.19	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 05B

TEST	850608	850609 *	850913	850914 *
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	280.	370.	440.	530.
ALKOH	<5.0	--	<5.0	--
B	.11	--	.10	--
CA	64.	--	100.	--
CL	9.8	--	13.	--
COND	54.	69.	80.	90.
K	1.1	--	1.5	--
MG	29.	--	44.	--
NA	12.	--	18.	--
PH	7.3	6.5	7.3	6.3
SO4	7.7	--	21.	--
SR	.21	--	.27	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 06A

TEST	850608	850609 *	850913	850914 *
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	570.	740.	580.	770.
ALKOH	<5.0	--	<5.0	--
B	.11	--	.11	--
CA	140.	--	97.	--
CL	12.	--	12.	--
COND	97.	120.	100.	120.
K	.90	--	1.1	--
MG	52.	--	38.	--
NA	19.	--	16.	--
PH	7.0	6.5	6.9	6.5
SO4	<.50	--	.66	--
SR	.32	--	.28	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 06B

TEST	850608	850609*	850913	850914*
			SAMPLING DATE	
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	630.	710.	730.	800.
ALKOH	<5.0	--	<5.0	--
B	.15	--	.20	--
CA	140.	--	170.	--
CL	18.	--	15.	--
COND	110.	120.	130.	120.
K	1.3	--	.93	--
MG	75.	--	84.	--
NA	11.	--	12.	--
PH	7.7	6.5	7.3	6.4
SO4	.80	--	.58	--
SR	.32	--	.35	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 07A

TEST	850608	850609*	850913	850914*
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	410.	510.	430.	620.
ALKOH	<5.0	--	<5.0	--
B	.060	--	.10	--
CA	93.	--	94.	--
CL	21.	--	16.	--
COND	77.	97.	77.	95.
K	1.2	--	.94	--
MG	45.	--	44.	--
NA	15.	--	14.	--
PH	6.9	6.5	6.9	6.4
SO4	.50	--	<.50	--
SR	.36	--	.25	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 07B

TEST	850608	850609*	850913	850914*
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	440.	530.	510.	660.
ALKOH	<5.0	--	<5.0	--
B	.10	--	.10	--
CA	110.	--	120.	--
CL	25.	--	13.	--
COND	83.	94.	88.	95.
K	1.3	--	1.8	--
MG	47.	--	49.	--
NA	10.	--	10.	--
PH	7.4	6.6	7.1	6.4
SO4	.50	--	.50	--
SR	.26	--	.26	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 08A

TEST	850608	850609*	850913	850914*
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	490.	670.	600.	730.
ALKOH	<5.0	--	<5.0	--
B	.23	--	.23	--
CA	100.	--	120.	--
CL	25.	--	14.	--
COND	90.	120.	92.	110.
K	.90	--	1.2	--
MG	56.	--	59.	--
NA	10.	--	12.	--
PH	6.7	6.5	6.8	6.4
SO4	.60	--	<.50	--
SR	.18	--	.18	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 08B

TEST	850608	850609 *	850913	850914 *
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	420.	490.	610.	580.
ALKOH	<5.0	--	<5.0	--
B	.11	--	.17	--
CA	72.	--	94.	--
CL	7.9	--	7.4	--
COND	74.	82.	100.	110.
K	.90	--	1.3	--
MG	44.	--	52.	--
NA	26.	--	62.	--
PH	7.6	6.7	7.8	6.7
SO4	.70	--	1.1	--
SR	.20	--	.39	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 09A

TEST	SAMPLING DATE 850608	850609 *	850913	850914 *
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	280.	350.	280.	450.
ALKOH	<5.0	--	<5.0	--
B	.060	--	.080	--
CA	61.	--	61.	--
CL	15.	--	14.	--
COND	55.	64.	53.	68.
K	.70	--	.77	--
MG	30.	--	28.	--
NA	13.	--	13.	--
PH	6.9	6.5	8.0	6.4
SO4	.80	--	1.1	--
SR	.15	--	.13	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 09B

TEST	850608	850609*	850913	850914 *
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	250.	310.	250.	270.
ALKOH	<5.0	--	<5.0	--
B	.060	--	.070	--
CA	56.	--	47.	--
CL	15.	--	14.	--
COND	50.	63.	48.	58.
K	1.2	--	1.0	--
MG	24.	--	23.	--
NA	14.	--	11.	--
PH	7.1	6.3	7.1	6.1
SO4	.90	--	30.	--
SR	.11	--	.090	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 10A

TEST	SAMPLING DATE 850608	850609 *	850913	850914 *
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	400.	460.	400.	520.
ALKOH	<5.0	--	<5.0	--
B	.090	--	.12	--
CA	94.	--	87.	--
CL	10.	--	14.	--
COND	78.	77.	76.	85.
K	.70	--	.92	--
MG	44.	--	43.	--
NA	14.	--	17.	--
PH	7.0	6.7	7.5	6.3
SO4	28.	--	30.	--
SR	.20	--	.20	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 10B

TEST	SAMPLING DATE 850608	850609*	850913	850914*
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	420.	520.	460.	500.
ALKOH	<5.0	--	<5.0	--
B	.090	--	.13	--
CA	94.	--	85.	--
CL	8.8	--	10.	--
COND	82.	92.	85.	100.
K	.50	--	.36	--
MG	49.	--	48.	--
NA	13.	--	15.	--
PH	7.4	6.5	7.3	6.2
SO4	36.	--	36.	--
SR	.20	--	.16	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 11A

TEST	SAMPLING DATE 850608	850609 *	850913	850914 *
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	410.	520.	400.	450.
ALKOH	<5.0	--	<5.0	--
B	.10	--	.21	--
CA	110.	--	85.	--
CL	11.	--	12.	--
COND	90.	98.	84.	92.
K	.70	--	.67	--
MG	50.	--	37.	--
NA	16.	--	14.	--
PH	6.9	6.5	7.1	6.4
SO4	74.	--	85.	--
SR	.31	--	.20	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 11B

TEST	850608	850609*	850913	850914*
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	500.	640.	420.	470.
ALKOH	<5.0	--	<5.0	--
B	.10	--	.22	--
CA	130.	--	100.	--
CL	7.4	--	10.	--
COND	100.	100.	90.	88.
K	.30	--	.53	--
MG	65.	--	52.	--
NA	13.	--	16.	--
PH	7.6	6.5	7.1	6.3
SO4	92.	--	87.	--
SR	.30	--	.24	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 12A

TEST	850608	850609 *	850913	850914 *
		SAMPLING DATE		
ALKCO3	<5.0	--	--	--
ALKHCO3	720.	920.	--	--
ALKOH	<5.0	--	--	--
B	.24	--	--	--
CA	170.	--	--	--
CL	11.	--	--	--
COND	120.	130.	--	--
K	2.3	--	--	--
MG	73.	--	--	--
NA	21.	--	--	--
PH	7.0	6.6	--	--
SO4	<.50	--	--	--
SR	.54	--	--	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 12B

TEST	850608	850609 *	850913	850914 *
	SAMPLING DATE			
ALKCO3	<5.0	--	--	--
ALKHCO3	510.	600.	--	--
ALKOH	<5.0	--	--	--
B	.15	--	--	--
CA	130.	--	--	--
CL	7.0	--	--	--
COND	94.	110.	--	--
K	2.2	--	--	--
MG	50.	--	--	--
NA	11.	--	--	--
PH	6.9	6.5	--	--
SO4	<.50	--	--	--
SR	.45	--	--	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 13A

TEST	850608	850609 *	850913	850914 *
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	270.	410.	280.	370.
ALKOH	<5.0	--	<5.0	--
B	.13	--	.12	--
CA	69.	--	55.	--
CL	11.	--	10.	--
COND	56.	80.	54.	64.
K	1.0	--	.79	--
MG	31.	--	22.	--
NA	9.5	--	7.3	--
PH	6.9	6.4	6.8	6.3
SO4	11.	--	13.	--
SR	.18	--	.10	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 13B

TEST	850608	850609*	850913	850914*
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	300.	400.	270.	340.
ALKOH	<5.0	--	<5.0	--
B	.15	--	.13	--
CA	65.	--	58.	--
CL	15.	--	12.	--
COND	61.	72.	52.	60.
K	1.2	--	.98	--
MG	38.	--	29.	--
NA	13.	--	12.	--
PH	7.2	6.2	6.8	6.1
SO4	4.6	--	4.7	--
SR	.14	--	.070	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 15A

TEST	SAMPLING DATE 850608	850609*	850913	850914*
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	350.	600.	360.	520.
ALKOH	<5.0	--	<5.0	--
B	.090	--	.090	--
CA	93.	--	120.	--
CL	28.	--	33.	--
COND	77.	100.	78.	100.
K	2.0	--	2.1	--
MG	42.	--	42.	--
NA	13.	--	16.	--
PH	6.7	6.5	6.7	6.5
SO4	24.	--	32.	--
SR	.20	--	.24	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 15B

TEST	850608	850609 *	850913	850914 *
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	450.	600.	330.	410.
ALKOH	<5.0	--	<5.0	--
B	.19	--	.10	--
CA	130.	--	97.	--
CL	34.	--	33.	--
COND	110.	120.	90.	100.
K	2.6	--	2.4	--
MG	66.	--	44.	--
NA	13.	--	16.	--
PH	6.8	6.4	6.6	6.1
SO4	92.	--	140.	--
SR	.24	--	.17	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 16A

TEST	850608	850609 *	850913	850914 *
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	290.	470.	250.	420.
ALKOH	<5.0	--	<5.0	--
B	2.8	--	3.6	--
CA	90.	--	82.	--
CL	12.	--	11.	--
COND	83.	100.	76.	100.
K	1.7	--	1.5	--
MG	39.	--	32.	--
NA	34.	--	43.	--
PH	6.4	6.3	6.5	6.2
SO4	140.	--	160.	--
SR	.26	--	.19	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 16B

TEST	850608	850609 *	850913	850914*
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	320.	340.	280.	320.
ALKOH	<5.0	--	<5.0	--
B	.61	--	1.8	--
CA	100.	--	100.	--
CL	8.1	--	11.	--
COND	66.	64.	77.	75.
K	3.6	--	1.3	--
MG	23.	--	31.	--
NA	12.	--	20.	--
PH	7.5	6.4	7.2	6.2
SO4	24.	--	140.	--
SR	.40	--	.16	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 18A

TEST	850608	850609 *	850913	850914*
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	320.	330.	350.	400.
ALKOH	<5.0	--	<5.0	--
B	.43	--	.49	--
CA	120.	--	100.	--
CL	21.	--	13.	--
COND	81.	76.	70.	70.
K	1.2	--	.92	--
MG	27.	--	31.	--
NA	11.	--	13.	--
PH	7.3	6.5	7.3	6.4
SO4	71.	--	27.	--
SR	.52	--	.42	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 18B

TEST	850608	850609*	850913	850914*
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	270.	280.	360.	400.
ALKOH	<5.0	--	<5.0	--
B	.45	--	.42	--
CA	83.	--	110.	--
CL	8.7	--	20.	--
COND	54.	52.	73.	74.
K	.70	--	.71	--
MG	19.	--	28.	--
NA	10.	--	10.	--
PH	7.8	6.9	7.7	7.0
SO4	7.0	--	26.	--
SR	.16	--	.21	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 19A

TEST	850608	850609*	850913	850914*
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	200.	260.	190.	250.
ALKOH	<5.0	--	<5.0	--
B	<.050	--	<.050	--
CA	62.	--	52.	--
CL	13.	--	6.7	--
COND	46.	47.	38.	36.
K	1.0	--	1.2	--
MG	16.	--	16.	--
NA	7.7	--	8.0	--
PH	7.7	6.6	7.3	6.4
SO4	16.	--	7.9	--
SR	.11	--	.10	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 19B

TEST	850608	850609*	850913	850914*
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	96.	120.	98.	160.
ALKOH	<5.0	--	<5.0	--
B	<.050	--	<.050	--
CA	24.	--	30.	--
CL	6.3	--	6.7	--
COND	26.	35.	23.	29.
K	.30	--	.63	--
MG	11.	--	11.	--
NA	8.1	--	10.	--
PH	7.5	6.3	7.4	6.9
SO4	17.	--	14.	--
SR	.060	--	.050	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 20A

TEST	850608	850609*	850913	850914*
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	490.	560.	510.	590.
ALKOH	<5.0	--	<5.0	--
B	1.4	--	1.8	--
CA	140.	--	160.	--
CL	15.	--	16.	--
COND	120.	120.	130.	120.
K	2.2	--	2.2	--
MG	62.	--	74.	--
NA	24.	--	32.	--
PH	6.9	6.4	7.1	6.2
SO4	130.	--	240.	--
SR	.26	--	.25	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 20B

TEST	850608	850609*	850913	850914*
			SAMPLING DATE	
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	510.	530.	530.	590.
ALKOH	<5.0	--	<5.0	--
B	.99	--	1.3	--
CA	160.	--	160.	--
CL	16.	--	17.	--
COND	120.	110.	130.	130.
K	2.0	--	2.5	--
MG	60.	--	68.	--
NA	22.	--	27.	--
PH	7.0	6.1	6.8	6.2
SO4	130.	--	210.	--
SR	.25	--	.25	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 21A

TEST	850608	850609*	850913	850914*
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	180.	200.	140.	210.
ALKOH	<5.0	--	<5.0	--
B	.070	--	.060	--
CA	52.	--	47.	--
CL	15.	--	12.	--
COND	44.	36.	32.	43.
K	1.2	--	1.3	--
MG	20.	--	16.	--
NA	7.4	--	7.9	--
PH	7.8	6.4	7.1	6.4
SO4	16.	--	15.	--
SR	.12	--	.080	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 21B

TEST	850608	850609 *	850913	850914 *
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	160.	150.	140.	170.
ALKOH	<5.0	--	<5.0	--
B	.52	--	.42	--
CA	48.	--	46.	--
CL	15.	--	12.	--
COND	38.	37.	31.	25.
K	2.6	--	2.1	--
MG	17.	--	14.	--
NA	10.	--	6.9	--
PH	7.8	6.1	7.0	6.7
SO4	4.6	--	6.7	--
SR	.20	--	.14	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 22A

TEST	850608	850609 *	850913	850914 *
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	550.	620.	530.	620.
ALKOH	<5.0	--	<5.0	--
B	.15	--	.18	--
CA	140.	--	130.	--
CL	20.	--	20.	--
COND	110.	98.	100.	100.
K	1.7	--	1.8	--
MG	51.	--	50.	--
NA	38.	--	45.	--
PH	7.1	6.7	7.3	6.7
SO4	21.	--	21.	--
SR	.81	--	.31	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL GROUNDWATER QUALITY - TBTGS - 1985

LOCATION : 22B

TEST	850608	850609 *	850913	850914 *
	SAMPLING DATE			
ALKCO3	<5.0	--	<5.0	--
ALKHCO3	600.	670.	650.	680.
ALKOH	<5.0	--	<5.0	--
B	.31	--	.44	--
CA	130.	--	120.	--
CL	1.8	--	1.7	--
COND	100.	93.	110.	33.
K	.30	--	.73	--
MG	61.	--	65.	--
NA	39.	--	28.	--
PH	7.7	6.5	7.3	6.1
SO4	14.	--	6.1	--
SR	.26	--	.23	--

*TBTGS field data: Dated one day after actual sampling for convenience of computer retrieval.

ASH CELL

ION BALANCES - TBTGS - 1985

MAJOR ION CHEMISTRY

TBTGS ASH
JUNE 08 1985
TYPE - WATER

ASH CELL GROUNDWATER QUALITY - 1985

ANIONS												ANION TOTAL	CATION TOTAL	
CL			SO4			HCO3			CO3					
MG/L	EPM	%EPM	MG/L	EPM	%EPM	MG/L	EPM	%EPM	MG/L	EPM	%EPM	EPM	EPM	
52	1.46	12	69	1.44	12	543	8.90	75	<5.00	.00	0	11.80	11.69	
131	3.69	27	7	.14	1	606	9.94	72	<5.00	.00	0	13.76	16.01*	
8	.21	2	18	.37	4	573	9.40	94	<5.00	.00	0	9.99	9.81	
9	.25	2	32	.67	6	575	9.42	91	<5.00	.00	0	10.34	10.39	
12	.34	3	2	.04	0	601	9.86	96	<5.00	.00	0	10.24	9.96	
17	.48	4	2	.05	0	622	10.20	95	<5.00	.00	0	10.72	10.99	
9	.24	3	1	.01	0	417	6.84	96	<5.00	.00	0	7.09	7.21	
38	1.07	10	1	.02	0	617	10.12	90	<5.00	.00	0	11.21	11.06	
9	.24	4	1	.02	0	342	5.60	95	<5.00	.00	0	5.87	5.87	
25	.70	7	143	2.98	29	411	6.74	65	<5.00	.00	0	10.42	10.50	
10	.28	5	8	.16	3	339	5.56	93	<5.00	.00	0	5.99	6.12	
12	.33	3	<.500	.00	0	691	11.32	97	<5.00	.00	0	11.65	11.95	+
18	.51	4	1	.02	0	772	12.66	96	<5.00	.00	0	13.18	13.90	
21	.59	7	1	.01	0	498	8.16	93	<5.00	.00	0	8.76	9.03	
25	.70	7	1	.01	0	543	8.90	93	<5.00	.00	0	9.61	9.69	
25	.70	7	1	.01	0	598	9.80	93	<5.00	.00	0	10.51	10.13	
8	.22	3	1	.01	0	508	8.32	97	<5.00	.00	0	8.55	8.37	
15	.43	7	1	.02	0	342	5.60	93	<5.00	.00	0	6.04	6.12	
15	.43	8	1	.02	0	305	5.00	92	<5.00	.00	0	5.45	5.43	
11	.30	3	28	.58	7	484	7.94	90	<5.00	.00	0	8.82	8.95	
9	.25	3	36	.75	8	518	8.50	89	<5.00	.00	0	9.49	9.30	
11	.30	3	74	1.54	15	499	8.18	82	<5.00	.00	0	10.02	10.36	
7	.21	2	92	1.91	16	610	10.00	82	<5.00	.00	0	12.12	12.46	
11	.31	2	<.500	.00	0	883	14.48	98	<5.00	.00	0	14.79	15.41	+
7	.20	2	<.500	.00	0	625	10.24	98	<5.00	.00	0	10.43	11.18	+
11	.31	5	11	.23	4	334	5.48	91	<5.00	.00	0	6.02	6.43	
15	.43	7	5	.10	1	368	6.04	92	<5.00	.00	0	6.56	6.97	
28	.79	9	24	.50	6	428	7.02	84	<5.00	.00	0	8.31	8.72	
34	.96	8	92	1.91	16	545	8.94	76	<5.00	.00	0	11.81	12.69	
12	.34	4	140	2.91	32	354	5.80	64	<5.00	.00	0	9.05	9.22	
8	.23	3	24	.50	7	395	6.48	90	<5.00	.00	0	7.21	7.63	
21	.59	7	71	1.48	17	393	6.44	76	<5.00	.00	0	8.51	8.83	
9	.25	4	7	.15	3	326	5.34	93	<5.00	.00	0	5.73	6.16	
13	.36	8	16	.34	7	239	3.92	85	<5.00	.00	0	4.62	4.74	
6	.18	7	17	.35	14	117	1.92	79	<5.00	.00	0	2.44	2.50	
15	.42	3	133	2.77	21	598	9.80	75	<5.00	.00	0	12.98	13.38	
16	.44	3	134	2.79	21	619	10.14	76	<5.00	.00	0	13.37	13.93	
15	.41	9	16	.33	7	223	3.66	83	<5.00	.00	0	4.40	4.59	
15	.43	11	5	.10	3	196	3.22	86	<5.00	.00	0	3.74	4.29*	
20	.56	5	21	.44	4	677	11.10	92	<5.00	.00	0	12.10	12.68	

MAJOR ION CHEMISTRY

TBTGS ASH
JUNE 08 1985
TYPE - WATER

ASH CELL GROUNDWATER QUALITY - 1985

CATIONS												CATION TOTAL	ANION TOTAL
CA			MG			NA			K				
MG/L	EPM	%EPM	MG/L	EPM	%EPM	MG/L	EPM	%EPM	MG/L	EPM	%EPM	EPM	EPM
138	6.88	59	49	4.03	34	17	.74	6	2	.04	0	11.69	11.80
180	8.98	56	75	6.17	39	19	.80	5	2	.05	0	16.01	13.76*
112	5.59	57	43	3.54	36	15	.66	7	1	.03	0	9.81	9.99
127	6.33	61	42	3.46	33	13	.57	5	1	.03	0	10.39	10.34
118	5.89	59	38	3.13	31	21	.91	9	1	.03	0	9.96	10.24
133	6.63	60	49	4.03	37	7	.30	3	1	.03	0	10.99	10.72
80	3.99	55	30	2.47	34	17	.72	10	1	.03	0	7.21	7.09
128	6.38	58	35	2.88	26	40	1.74	16	2	.05	0	11.06	11.21
71	3.54	60	23	1.89	32	10	.41	7	1	.02	0	5.87	5.87
115	5.74	55	46	3.79	36	22	.96	9	1	.02	0	10.50	10.42
64	3.19	52	29	2.39	39	12	.51	8	1	.03	0	6.12	5.99
137	6.83	57	52	4.28	36	19	.82	7	1	.02	0	11.95	11.65
145	7.23	52	75	6.17	44	11	.46	3	1	.03	0	13.90	13.18
93	4.64	51	45	3.70	41	15	.66	7	1	.03	0	9.03	8.76
107	5.34	55	47	3.87	40	10	.45	5	1	.03	0	9.69	9.61
101	5.04	50	56	4.61	46	11	.46	5	1	.02	0	10.13	10.51
72	3.59	43	44	3.62	43	26	1.13	14	1	.02	0	8.37	8.55
61	3.04	50	30	2.47	40	14	.59	10	1	.02	0	6.12	6.04
56	2.79	51	24	1.98	36	15	.63	12	1	.03	1	5.43	5.45
94	4.69	52	44	3.62	40	14	.63	7	1	.02	0	8.95	8.82
94	4.69	50	49	4.03	43	13	.57	6	1	.01	0	9.30	9.49
111	5.54	53	50	4.12	40	16	.70	7	1	.02	0	10.36	10.02
131	6.53	52	65	5.35	43	13	.57	5	0	.01	0	12.46	12.12
169	8.43	55	73	6.01	39	21	.91	6	2	.06	0	15.41	14.79
131	6.53	58	50	4.12	37	11	.48	4	2	.06	1	11.18	10.43
69	3.44	54	31	2.55	40	10	.41	6	1	.03	0	6.43	6.02
65	3.24	47	38	3.13	45	13	.57	8	1	.03	0	6.97	6.56
93	4.64	53	42	3.46	40	13	.57	7	2	.05	1	8.72	8.31
133	6.63	52	66	5.43	43	13	.56	4	3	.07	1	12.69	11.81
90	4.49	49	39	3.21	35	34	1.48	16	2	.04	0	9.22	9.05
103	5.14	67	23	1.89	25	12	.50	7	4	.09	1	7.63	7.21
122	6.08	69	27	2.22	25	11	.50	6	1	.03	0	8.83	8.51
83	4.14	67	19	1.56	25	10	.44	7	1	.02	0	6.16	5.73
62	3.09	65	16	1.28	27	8	.33	7	1	.03	1	4.74	4.62
24	1.20	48	11	.94	38	8	.35	14	0	.01	0	2.50	2.44
144	7.18	54	62	5.10	38	24	1.04	8	2	.06	0	13.38	12.98
160	7.98	57	60	4.94	35	22	.96	7	2	.05	0	13.93	13.37
52	2.59	56	20	1.65	36	7	.32	7	1	.03	1	4.59	4.40
48	2.39	56	17	1.40	33	10	.43	10	3	.07	2	4.29	3.74*
136	6.78	54	51	4.20	33	38	1.65	13	2	.04	0	12.68	12.10

MAJOR ION CHEMISTRY

TBTGS ASH
SEPT 13 1985
TYPE - WATER

ASH CELL GROUNDWATER QUALITY - 1985

ANIONS												ANION TOTAL	CATION TOTAL
CL			SO4			HCO3			CO3				
MG/L	EPM	%EPM	MG/L	EPM	%EPM	MG/L	EPM	%EPM	MG/L	EPM	%EPM	EPM	EPM
61	1.70	12	64	1.33	9	688	11.28	79	<5.00	.00	0	14.31	12.61*
95	2.68	20	5	.10	1	633	10.38	79	<5.00	.00	0	13.16	13.06
8	.23	2	19	.39	4	572	9.38	94	<5.00	.00	0	10.00	9.76
6	.16	1	18	.38	3	650	10.66	95	<5.00	.00	0	11.20	11.17
14	.39	4	2	.05	0	603	9.88	96	<5.00	.00	0	10.32	10.17
24	.68	5	87	1.82	12	736	12.06	83	<5.00	.00	0	14.55	14.97
10	.27	4	1	.02	0	410	6.72	96	<5.00	.00	0	7.01	6.93
22	.61	7	2	.03	0	523	8.58	93	<5.00	.00	0	9.22	9.09
9	.25	3	6	.12	2	407	6.68	95	<5.00	.00	0	7.05	6.98
24	.66	6	157	3.27	32	382	6.26	61	<5.00	.00	0	10.19	10.12
13	.36	4	21	.44	5	543	8.90	92	<5.00	.00	0	9.69	9.54
12	.34	3	1	.01	0	708	11.60	97	<5.00	.00	0	11.95	8.67*
15	.42	3	1	.01	0	895	14.68	97	<5.00	.00	0	15.11	15.84
16	.46	5	<.500	.00	0	525	8.60	95	<5.00	.00	0	9.05	8.93 +
13	.35	3	1	.01	0	617	10.12	97	<5.00	.00	0	10.48	10.58
15	.41	3	<.500	.00	0	727	11.92	97	<5.00	.00	0	12.32	11.64 +
7	.21	2	1	.02	0	743	12.18	98	<5.00	.00	0	12.41	11.74
15	.41	7	1	.02	0	346	5.68	93	<5.00	.00	0	6.11	5.94
14	.40	7	30	.62	11	300	4.92	83	<5.00	.00	0	5.95	4.79*
14	.41	4	30	.63	7	492	8.06	89	<5.00	.00	0	9.09	8.64
10	.28	3	36	.75	7	566	9.28	90	<5.00	.00	0	10.31	8.83*
12	.34	3	85	1.76	17	488	8.00	79	<5.00	.00	0	10.10	7.92*
10	.28	3	87	1.82	17	511	8.38	80	<5.00	.00	0	10.47	10.13
11	.30	5	13	.26	4	342	5.60	91	<5.00	.00	0	6.15	4.91*
12	.33	6	5	.10	2	328	5.38	93	<5.00	.00	0	5.81	5.85
34	.94	11	32	.66	7	443	7.26	82	<5.00	.00	0	8.86	10.07*
33	.93	9	141	2.93	28	398	6.52	63	<5.00	.00	0	10.38	9.27*
11	.31	4	162	3.37	39	304	4.98	57	<5.00	.00	0	8.66	8.68
11	.31	3	139	2.89	33	345	5.66	64	<5.00	.00	0	8.86	8.46
14	.38	5	27	.57	7	433	7.10	88	<5.00	.00	0	8.05	8.32
20	.56	7	26	.54	6	444	7.28	87	<5.00	.00	0	8.38	8.42
7	.19	5	8	.16	4	229	3.76	91	<5.00	.00	0	4.11	4.27
7	.19	8	14	.29	12	120	1.96	80	<5.00	.00	0	2.43	2.87*
16	.44	3	242	5.04	32	627	10.28	65	<5.00	.00	0	15.75	15.52
17	.48	3	213	4.43	29	642	10.52	68	<5.00	.00	0	15.43	14.99
12	.34	10	15	.32	9	170	2.78	81	<5.00	.00	0	3.44	4.07*
12	.35	11	7	.14	4	171	2.80	85	<5.00	.00	0	3.29	3.77*
20	.56	5	21	.44	4	653	10.70	91	<5.00	.00	0	11.70	12.32
2	.05	0	6	.13	1	793	13.00	99	<5.00	.00	0	13.17	12.76

MAJOR ION CHEMISTRY

TBTGS ASH
SEPT 13 1985
TYPE - WATER

ASH CELL GROUNDWATER QUALITY - 1985

CATIONS												CATION TOTAL	ANION TOTAL
CA			MG			NA			K				
MG/L	EPM	%EPM	MG/L	EPM	%EPM	MG/L	EPM	%EPM	MG/L	EPM	%EPM	EPM	EPM
143	7.13	57	56	4.57	36	20	.86	7	2	.04	0	12.61	14.31*
144	7.18	55	61	5.00	38	19	.82	6	2	.05	0	13.06	13.16
108	5.39	55	45	3.71	38	14	.62	6	1	.04	0	9.76	10.00
137	6.83	61	48	3.93	35	9	.38	3	1	.02	0	11.17	11.20
115	5.74	56	41	3.37	33	24	1.03	10	1	.03	0	10.17	10.32
182	9.08	61	65	5.31	35	13	.56	4	1	.03	0	14.97	14.55
78	3.88	56	27	2.26	33	18	.77	11	1	.03	0	6.93	7.01
110	5.49	60	33	2.73	30	19	.83	9	1	.04	0	9.09	9.22
84	4.18	60	27	2.25	32	12	.52	7	1	.03	0	6.98	7.05
113	5.64	56	47	3.84	38	14	.62	6	1	.03	0	10.12	10.19
102	5.09	53	44	3.64	38	18	.78	8	1	.04	0	9.54	9.69
97	4.82	56	38	3.11	36	17	.72	8	1	.03	0	8.67	11.95*
168	8.38	53	84	6.91	44	12	.53	3	1	.02	0	15.84	15.11
94	4.68	52	44	3.61	40	14	.61	7	1	.02	0	8.93	9.05
121	6.03	57	49	4.07	38	10	.43	4	2	.05	0	10.58	10.48
124	6.18	53	60	4.90	42	12	.52	4	1	.03	0	11.64	12.32
94	4.70	40	52	4.30	37	62	2.70	23	1	.03	0	11.74	12.41
61	3.05	51	28	2.31	39	13	.55	9	1	.02	0	5.94	6.11
47	2.35	49	23	1.92	40	11	.49	10	1	.03	1	4.79	5.95*
87	4.32	50	43	3.56	41	17	.73	8	1	.02	0	8.64	9.09
85	4.22	48	48	3.95	45	15	.65	7	0	.01	0	8.83	10.31*
85	4.25	54	37	3.06	39	14	.59	7	1	.02	0	7.92	10.10*
103	5.14	51	52	4.30	42	16	.68	7	1	.01	0	10.13	10.47
55	2.76	56	22	1.82	37	7	.32	6	1	.02	0	4.91	6.15*
58	2.91	50	29	2.40	41	12	.52	9	1	.03	0	5.85	5.81
117	5.84	58	43	3.50	35	16	.68	7	2	.05	1	10.07	8.86*
97	4.86	52	44	3.65	39	16	.70	8	2	.06	1	9.27	10.38*
82	4.11	47	33	2.67	31	43	1.85	21	2	.04	0	8.68	8.66
101	5.04	60	31	2.53	30	20	.85	10	1	.03	0	8.46	8.86
103	5.14	62	32	2.59	31	13	.57	7	1	.02	0	8.32	8.05
113	5.64	67	28	2.31	27	10	.45	5	1	.02	0	8.42	8.38
52	2.61	61	16	1.28	30	8	.35	8	1	.03	1	4.27	4.11
30	1.48	52	11	.94	33	10	.44	15	1	.02	1	2.87	2.43*
160	7.98	51	74	6.07	39	33	1.41	9	2	.06	0	15.52	15.75
164	8.18	55	68	5.57	37	27	1.17	8	3	.06	0	14.99	15.43
47	2.34	57	17	1.36	33	8	.34	8	1	.03	1	4.07	3.44*
46	2.30	61	14	1.12	30	7	.30	8	2	.05	1	3.77	3.29*
125	6.23	51	50	4.10	33	45	1.94	16	2	.05	0	12.32	11.70
124	6.18	48	65	5.33	42	28	1.23	10	1	.02	0	12.76	13.17

ES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ES A MAJOR PARAMETER IS MISSING.